ENGINEERING LITERATURE

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There are many words used to designate the intensity factor in electrical phenomena. Difference of potential, or potential difference, p. d., is as exact as any other, and seems to be the preferred one in most theoretical and many practical discussions. A more common one, though less widely applicable, is Electro Motive Force, as it was originally written, or electromotive force, usually abbreviated E. M. F., but sometimes e. m. f. If we do not wish to use either of these two terms, we may use the expression electrical pressure, or, simply, pressure; or, reversing the metaphor, we may speak of electrical tension, of electric current at a tension of so many volts. In fact, if we become careless, we may say that a certain high-tension transmission circuit, carrying three-phase alternating current, operates with a pressure of 10,000 volts between phases. A rather convenient word, still referring to the same thing, is potential, which seems almost tangibly real when we speak, say, of line-potential; in some cases, when the simple word potential is not suitable, we change it to the more complete form potential difference, already noted above. Handiest and easiest of all is just voltage, which consequently has the call in the largest number of cases.

These are some of the expressions used at different times for what is essentially the same thing, and no doubt there are still others. This multiplicity of terms is not wholly objectionable, and we do not call attention to it for the purpose of denouncing it. On the contrary, we wish to point out that it gives us a wide range of choice, and that it should enable us to avoid those terms in the list that are least desirable. Our particular dislike is for the compound conglomeration electromotive force, abbreviated e. m. f.

A term representing a single property or phenomenon should be a single term, distinctive and short, if the term is important and is frequently used. It is the possession of such terms in place of combinations formed from a few elementary root words, that distinguishes a civilized language. In the expression electromotive force we have a noun borrowed from mechanics, afflicted with a compound adjective intended to be roughly descriptive of the qualities of the thing described. Such a thing might be permissible if the term were for temporary use, only, with no likelihood of being adopted for permanent use. But electromotive force is a very important designation and one constantly used in a large and important branch of science. Its clumsiness as a technical term was long ago recognized, and for brevity the initials of the component words were used in place of the whole expression—a very unsatisfactory expedient, saving little time in writing and none whatever in reading.

Electromotive force should be dropped from the terminology of engineering. It stands worthily beside that other abomination, moment of inertia, and is surpassed only by its own derivative—counter electromotive force. It is not absolutely necessary that a substitute term should be found at once, or found at all, since the half-dozen other names cited above will offer a sufficient choice. But if desired a substitute name might easily be found or formed, and the great solidarity of the electrical interests of the country ought to be able to ensure such a substitute a rapid adoption.

The Dearth of Cost Data in Technical Literature.

The engineer or contractor who is called upon to estimate the cost of an engineering work and who turns to technical literature for aid is generally disappointed at the lack of reliable data. Frequently he will find actual costs recorded with great minuteness, but when he looks for the rate of wages paid the workmen he is apt to look in vain. This is not merely an occasional oversight on the part of writers, but occurs so frequently as to be the rule rather than the exception. As everyone knows, the rate of wages is constantly fluctuating. To-day it may be 15 cts. an hour for common labor in a given place, and a few months hence it may be 18¾ cts. an hour due to a change from the 10-hour day to the 8-hour day, or from other causes.

Furthermore, there are wide variations in rates of wages paid in places separated but a few miles. For example, teams in a city often receive 50 cts. an hour when outside the same city limits teams may be hired for 35 cts. an hour.

Other omissions are frequent even where writers pretend to give statements of cost. Unit prices of the materials used are as important to the engineer as the rates paid to labor, yet they are often omitted where statement of the total cost is given.

There are several reasons for the failure of engineers to present figures of cost in their contributions to technical literature. One probable reason is that cost data are regarded by some as an engineer's "stock in trade." But if figures of cost are valuable to the engineer, they are surely much more valuable to the contractor.

A contractor, for example, should know what a given piece of work will cost to perform in order to make a bid which will yield him a fair profit, but which will not be so excessive as to lose the job. Yet a large proportion of successful contractors have no very definite knowledge of the cost of their work. The fact is that a large number of elements enter into a contractor's success, of which accurate knowledge of costs is one of the least important. For example, a contractor must know where he can find competent foremen who will so handle men as to secure a fair day's work; and such foremen are not easily picked up. They are generally found only by a process of weeding out, or natural selection, extending over a term of years, and when found are held by the finder.

Secondly, the contractor must either possess or know how and where to borrow capital with which to operate, and must be able to secure bondsmen. Thirdly, he must be a good business man and know how to buy and where. Fourthly, he must have a knowledge of human nature and have the power to organize and discipline his forces, to secure efficient and harmonious work.

Taking all in all, his knowledge of costs weighs exceedingly light in the scales beside the qualifications just enumerated. Therefore, even the contractor has little if anything to lose by making public certain of his cost data, and he would gain much by an interchange of knowledge with his fellow contractors.

If, now, the contractor can afford to make public his figures of cost, surely the engineer—who is currently supposed to owe a certain duty to the profession—cannot afford to withhold such information.

So much for the stock-in-trade idea. There is another reason which probably more frequently than any other controls the engineer in withholding figures of cost. It is the objection on the part of his superior officers to the publication of such figures. This objection in ninety-nine cases out of a hundred rests on no good ground. It is simply and merely traditional business policy. As such, however, it is a controlling force. The engineer in describing a piece of work naturally refrains from anything which might be considered by his employer as revealing private information; and where there is any doubt or question, he will omit data merely on the chance that it might be objected to.

On the other hand, there are large classes of work to which this objection does not apply. All public work for States, municipalities or the general government is matter of public record, and engineers engaged on it can freely make public their results for the general benefit. For an example of this we may take the electric lighting industry. One will search long in technical literature to find accurate data of the cost of building and operating electric light plants owned by private companies; but plenty of such data has been obtained from electric light plants owned by municipalities.

A third reason for the omission of cost data may be called mental inertia or sheer failure to comprehend the usefulness of such data to other engineers. Many engineers, when they sit down to write a professional paper undertake the work from a wrong point of view. What is wanted is not primarily a description of a given piece of work. Description there will doubtless be, but it ought to be subordinate to the main purpose. This main purpose should be to record just those facts and figures which will be of direct practical use to other members of the profession. These should be the prominent part of the paper, too, and not buried in a mass of useless descriptive matter. We would not, on the other hand, ignore literary quality in such work. A dry record of facts and figures is actually less instructive than the same information presented in such an interesting manner that it compels the attention of the reader and impresses the salient facts upon his memory.

Nevertheless, while literary excellence is not to be neglected, it is not the main basis on which to judge the merits of a contribution to engineering literature. The proper basis is the value of that contribution to the professional reader. If it offers new solutions for old problems, new methods of overcoming common difficulties, new data on which to base computations of the strength and safety of works and of the cost of their execution, —by such things as these is its value chiefly to be judged.

CORRESPONDENCE.

A Small Library for a Young Civil Engineer.

Sir: Your inquiry in regard to a list of books best suited for young engineers is one which many engineers have been troubled with. I enclose a list which I have found to be very satisfactory in general engineering work.

Very truly yours, L. D. Cornish, C. E.

U. S. Engineer Office, Beaver, Pa., April 6, 1903.

1. Trautwine's Civil Engineer's Pocket-Book.
2. Searle's Field Engineering.
3. Kent's Pocket-Book.
4. Waddell's De Pontibus.
5. Carnegie's Hand-Book.
6. Byrne's Inspection of Materials and Workmanship.
7. Lanza's Applied Mechanics.
8. Merriman & Jacoby's Roofs and Bridges.
9. Merriman's Hydraulics.
10. Webb's Railroad Construction.
11. Wellington's Location of Railways.
12. Johnson's Modern Framed Structures.
13. " Materials of Construction.
14. " Theory and Practice of Surveying.
15. " Contracts and Specifications.
16. Folwell's Sewerage.
17. Folwell's Water Supply Engineering.
18. Baker's Masonry Construction.
19. Baker's Highway Construction.
20. Patton's Civil Engineering.
21. Patton's Treatise on Foundations.
22. Wilson's Irrigation Engineering.
23. Vega's Logarithms.
24. Reinhardt's Lettering.
25. Reinhardt's Technic of Mechanical Drafting.

Books and Papers on Sewage Filtration and Septic Tanks.

Sir: Will you kindly supply me names and numbers of books or journals containing information relating to filters in actual operation for purifying sewage; crude sewage or sewage which has been treated. Likewise, I wish to secure literature on practical construction and operation of septic tanks. Very respectfully,

W. J. Atkinson, Acting Chief Engineer,
Zion Land & Investment Co.

Zion City, Ill., April 3, 1903.

(The only book containing descriptions of American sewage purification plants is Rafter and Baker's "Sewage Disposal in the United States" ($6). When it was written, about ten years ago, it covered every municipal plant in the country, and some others besides. "Waring's "Modern Methods of Sewage Disposal" (New York, 1894,) describes a number of plants built by the author, most of which made use of some form of irrigation. For descriptions of later plants, including the recent types of rapid filter beds, and also septic tanks, files of Engineering News and the other engineering papers may be consulted, using, to locate the articles, the "General Index to Engineering News 1890 to 1899" ($2.50), and the half-yearly volume indexes since that date; also, for general references, the "Engineering Index, 1896 to 1900" ($7.50). There are several good English books on septic tanks and rapid filtration, including Rideal's "Sewage" (London and New York, $3.50); Barwise's "Bacterial Purification of Sewage" (London, 1901; $2.50). These processes are also discussed from the standpoint of those favoring the older methods of land treatment in Jones and Roechling's "Natural and Artificial Sewage Treatment" (London and New York, 1902; $1.40), reviewed elsewhere in this issue. Of the scattered literature referred to above special mention may be made of a description of the design and operation of a number of septic tanks and rapid filters presented by Mr. John W. Alvord, M. Am. Soc. C. E., before the Western Society of Engineers, and published in the recent proceedings of that body; of the two papers on the septic tank in the last two annual reports of the Connecticut Sewerage Commission, one of which is noticed in this issue; and of the vast amount of information on intermittent filtration, rapid filtration, and septic tanks in the annual reports of the Massachusetts State Board of Health.—Ed.)

Literature on Underground Water Supplies.

Sir: This city is at present agitated over the question of public ownership of its water supply, and it is proposed to install an entirely new system. Some gravel beds near the city are most favorably considered, although there is a great difference of opinion regarding the capacity and permanence of the possible supply from this source. Will you kindly, through the columns of your literary supplement (for other engineers may be interested) refer me to books, articles and reports that will afford information as to experience with underground sources of water supply —capacity, permanence, quality of water and methods of securing same, and probable trouble regarding water rights.

Thanking you in advance for any favor you may grant me in this regard, and expressing my increasing satisfaction with your most able journal, I remain,

Respectfully yours, E. T. Thurston, Jr.

1017 14th St., Oakland, Cal., March 18, 1903.

(Elsewhere in this issue will be found a notice of an admirable discussion of this subject, entitled "The Motions of Underground Water," by Professor Slichter. The review refers to an earlier publication of the U. S. Geological Survey on the same general topic.

The development of underground water supplies is also treated in Turneaure & Russell's "Public Water Supplies" (New York, 1901; $5), which would be useful in other directions for anyone considering water-works construction, particularly as at the end of the most important chapters the authors give many references to the literature of the subject. The other books on water-works, as Folwell, Fanning and Goodell, also discuss ground water supplies.—Ed.)

A Group of Books on Electrical Engineering and Allied Topics.

Reviewed by Prof. Henry H. Norris.*

CONDUCTORS FOR ELECTRICAL DISTRIBUTION.—Their Materials and Manufacture, the Calculation of Circuits, Pole-Line Construction, Underground Working, and Other Uses. By F. A. C. Perrine, M. Am. Inst. E. E. New York: D. Van Nostrand Co. Cloth; 6 × 9 ins.; pp. 287; illustrated. $3.50 net.

Dr. Perrine has rendered no small service to the electrical fraternity in giving it in authoritative and systematic form, and in very readable style, the benefit of his extensive experience as a manufacturer and as a user of electrical conductors. A careful reading of the book will impress any one with the fact that engineering ability of a high order is necessary to properly plan and install a circuit for the transmission of alternate current power and that even in the design of the more familiar lighting and power circuits there are many problems which require intelligent judgment for their solution. The engineer must understand the properties of the different materials available for use as electrical conductors, as well as those methods of wire manufacture which will insure the required combination of electrical conductivity and tensile strength. He should know the requirements of different classes of service in the matter of insulation, and to that end should be familiar with insulating materials and with the methods of applying these to the conductors. These conductors must be installed upon substantial pole lines or in undergruond conduits, and, finally, the constants of the line, resistance, inductance and capacity, must be so proportioned as to deliver power under the most economical conditions.

The subject matter of Dr. Perrine's book may be roughly divided into two parts: A study of the selection and preparation of electric conductor materials for all classes of service, and a practical analysis of the problems encountered in erecting and operating electric circuits formed of these conductors. The author first treats of the pure metals which are almost invariably used as conductors for the economical transmission of current, these being copper, iron and aluminum. The matters of specific conductivity, temperature coefficient, and tensile strength of these materials are thoroughly covered, and the latest information is conveniently tabulated. A chapter is also devoted to those alloys of metals which are found useful for resistances, both as standards and as devices for the consumption of electro-motive force and for fuses which will melt when the current exceeds a certain value.

The topics which may be regarded as the most valuable are those treating of the various processes of wire manufacture. Not that the chapters on the electric circuit are not equally excellent in material and in method of presentation, but those on manufacturing methods contain much material usually either inaccessible or demanding great labor for its acquirement. The reader is able to follow the manufacturing processes, from that in which the "wire bar" or ingot of metal from the rolling-mill starts on its journey through the rolls, to the final one in which the fully insulated wire is given its last "slicking" or is covered with its sheath of lead or its armor of steel. The text and the excellent illustrations make entirely clear the details of the various operations, which include rolling, annealing, drawing, finishing, insulating and sheathing or armoring. Attention is especially directed to the chapter on insulation, a subject which no user of electrical conductors can understand too thoroughly, and upon which an enormous amount of experimenting has been done. The author classifies the methods of insulating wires in such a way as to show that each conductor must be insulated for the particular environment in which it will find itself. A large variety of materials are available for use as insulators, each having some particular point of excellence. The principal substances so used are cotton, silk, gutta-percha, rubber and the various waxes, such as asphaltum compounds. The sources and methods of preparation of these materials are given in detail, and the machines used for winding or braiding the yarn, for molding the enclosing envelope of gutta-percha or rubber, for saturating the fibrous material with waxy compound, and for applying the sheathing or armor are described and illustrated. In addition an impartial estimate of the values of the various materials is interwoven with the descriptive matter.

The second part of the treatment, beginning with the chapter on the calculation of circuits, includes first the important principles underlying the design of these circuits. This design includes the selection of the proper size of wire, determined either by the absolute value of the amount of power to be lost in the line or by the proportion of the total power which is to be thus dissipated. Different classes of service impose different specifications in this regard; for example, in some cases a certain fall in pressure is not to be exceeded. Under other circumstances the conductor must transmit power in such a way that the total annual cost, including interest and depreciation of the line, plus the annual value of the lost energy, must be a minimum. In all cases the conductor must not carry such a current that the temperature will be raised to an undesirable extent, this temperature being limited by the effect on the insulation, by the fire risk involved, or by the effect of high temperature on the electrical and mechanical properties of the conductor. In this connection the author introduces a feature that will be appreciated by electrical designers and others interested, in the form of a system of charts for reducing the labor of electrical circuit calculations. The theory underlying the invention of such devices is explained, and a number of large and useful charts are inserted in a pocket in the cover of the book. A number of slide rules especially designed for the solution of circuit equations are illustrated and described.

As mentioned above, many circuits must be designed from the standpoint of maximum financial economy. The well-known Kelvin's law states that this status exists when the interest and depreciation on those parts of the line which vary with its size are equal to the annual money value of the energy lost therein. In applying this law, which in its simple form is perfectly obvious, the designer meets with several important difficulties. The principal one of these is that the cost of the line does not vary directly with the size of the conductor, but includes also the costs of insulation, right of way, construction and maintenance. The other is that the current carried is not uniform in value and hence allowance must be made for the particular rate of variation in each case. Dr. Perrine has treated these matters thoroughly by applying Kelvin's law to the general case, involving costs of right of way, poles and erection, cross-arms, pins and insulators, carriage, annual costs of line building, wire and maintenance, costs of electrical energy and the number of hours during which the current is annually used. The algebraic treatment

*Cornell University, Ithaca, N. Y.

is illustrated by diagrams giving curves showing the relations existing among the several variables. He obtains as the results of this study the following four cases of economy: (1) For the least possible cost of transmission; (2) for the greatest net revenue obtainable; (3) for the greatest net gain on capital involved; (4) for the greatest percentage gain on the total amount of capital annually involved.

While Kelvin's law determines the relation of current, sizes of conductors, and maximum financial economy, there are a number of considerations which determine the amount of current which will be required to convey a given power. The inductance and the capacity of the line, the allowable pressure, and the power factor of the load, determine the number of amperes per kilowatt of delivered power. The calculation of the line constants is of the greatest importance, especially in long lines, not only for determining the power factor, but also for predicting the variation of the voltage with the load. In the treatment of this part of his subject the author has had the collaboration of Mr. F. G. Baum, who is especially expert in matters of this kind. Formulae for calculating the line constants are developed and the results are tabulated in convenient form. There follows a valuable section on the regulation of transmission lines in which resistance, inductance, capacity and loads of known power factors are the constituent parts. The effect of a leading current in improving the regulation of a transmission line is clearly brought out, as well as the reason for the extremely poor regulation in case of an inductive receiver load.

A number of chapters at the close of the book are given to the mechanical and electrical properties of transmission lines viewed from the structural standpoint. These are considered under four heads, namely: (1) The location of the line in relation to the surface of the ground and neighboring obstructions; (2) the calculation of the strength of the line to withstand the strains produced by the line itself and by atmospheric conditions; (3) the adaptation of the insulators to the voltage so that they may withstand the puncturing strains under the conditions imposed by their location; and (4) the installation of the wire in such a way as to avoid uneven strains, as well as the strains produced by change of temperature or by other atmospheric conditions. It will be readily seen that the overhead line and the pole line must be designed for the most severe conditions under which they will operate, and that factors of safety must be selected to reduce risks to small proportions. The principles of mechanics which apply to this class of work are similar to those used in studying the action of beams under flexure with one end securely fastened and of the truncated cone form. The stresses on the poles are due to the weight of wire insulation and adhering ice or snow and the tension in the wire. The author has based upon these facts a number of formulae, with tables of constants, for determining the proper form and size of pole for any set of conditions, allowance being made for all of the factors entering into the problem. Data are also tabulated for calculating the relation of tensile strength and length of span, allowing for the change in tension due to variation of temperature.

The subject of line insulators is treated briefly but comprehensively and in descriptive style. This matter is one which has become of great importance within a few years as line pressures have been gradually raised in order to extend the range of electric power transmission. Both glass and porcelain are used in the production of line insulators, these substances being easily molded into the complicated forms desired. The glass insulators, being transparent, are more readily inspected for defects than the opaque porcelain, and they are more easily formed, but for high pressure work, and for lines under great mechanical strains, the porcelain is found to be best adapted. The porcelain is usually given a dark glaze, for one of the difficulties experienced in transmission lines has been the attraction of the white targets for stray marksmen. In the text the essentials of porcelain manufacture for electrical purposes is discussed in such a way as to enable a purchaser to know when he is getting the proper material for his line.

The final chapter, on underground conductors, deals with the devices used for protecting and insulating conductors where it is necessary or desirable to have them out of the way. The conductors for this purpose must be especially well insulated, and they are usually lead sheathed to protect the insulation from the action of water and gas. The wires are drawn into ducts, which are internally smooth, reasonably water and gas-tight, and of considerable mechanical strength to withstand the strains due to teaming on the streets above them. For this purpose wood, iron, terra-cotta and cement have been found satisfactory.

Dr. Perrine says in his preface that even after eight years consumed in writing and rewriting this book, and after having published it once in incomplete form, he hesitates to pass it on to the printer despairing of "completing the whole task of writing up to the present conditions of a rapidly moving art." While it is undoubtedly true that the art is moving onward rapidly, yet this work draws together in useful and interesting form the data now available for a study of electric conductors, and both the student and the practicing engineer will find valuable instruction in its perusal. The mathematical chapters contain nothing which cannot be readily followed by a college student, and even if the methods of deduction are not of interest to him the results are immediately available. Aside from the analytical chapters the non-mathematical reader will appreciate the descriptive material.

CHEMICAL TECHNOLOGY.—Vol. IV., Electric Lighting. By A. G. Cooke, Assoc. M. Inst. E. E. Photometry. By W. J. Dibdin, F. I. C., F. C. S. Philadelphia: P. Blakiston's Son & Co. Cloth; 7 × 10 ins.; pp. 378; tables, 10 plates, and 181 figures in the text. $3.50 net.

The title of the series of which this work forms a part would imply that each volume bears directly upon the chemical side of the subject treated. This proves not to be the case, in this instance at least, as the material is of the same general nature as that contained in other books, covering the fields of the theory and application of electricity (excepting motors) and of photometry. As the electrical side is concerned here with the production of light, and the photometric side with its measurement, the two subjects are fitly bound together under the same cover in a work of the scope of this one. As the subjects in themselves are entirely different the two parts will be examined separately.

In the electrical section it was apparently the intention of the editors to furnish information upon this subject which would enable a chemist to appreciate the possibilities of chemistry in engineering and of engineering in chemistry. That this is a desirable field for text and reference books there can be no doubt, for in the application of electro-chemistry there is great need for well trained engineers who are also chemists, as well as for chemists who know the foundation principles of electrical engineering. The chemical engineer is developing, and there is work for him. For this class of men the book before us should form a fairly satisfactory introductory treatise. The actual machines illustrated and described are not those which he will meet in this country, for with few exceptions the apparatus is of British manufacture. Although the author states that these have been chosen with the view to illustrating certain principles we believe that he could have chosen more modern machines and could have had better cuts made of them without sacrificing the teaching value of the text. The mechanical work of the cuts is not good, for aside from a few clear lithographic plates, there are line-cuts, wood-cuts and half-tones of ordinary quality. The reading matter is good, and while the arrangement strikes one as rather heterogeneous this is undoubtedly due to the vast field which the treatise covers. The non-mathematical form of writing is adopted, as the general reader has been kept in mind. As a consequence the pages present that smoothness due to absence of formulae which is often much admired by students. The assumption is made, however, that the reader is familiar with the definitions of the fundamental units, both mechanical and electrical.

At the outset the author divides the subject of electric lighting into: (1) The generation of electrical energy or better, the transformation of energy into the electrical form; (2) transmission to greater or less distances; (3) sub-division, with regulation, to the centers of illumination; (4) transformation of power into light. In the text this order is not followed, but the matter of electric conductors and circuits is first treated. Conductor materials, carrying capacity of conductors, insulation and the economics of circuit operation fill two chapters. More attention is given to magnetism, and of special excellence are a series of five plates showing hysteresis loops for wrought iron, annealed iron wire, cast iron, 0.32% carbon steel (annealed), annealed steel piano wire, and hard steel piano wire. The measurement of magnetic properties closes the elementary part of the book.

The theory of closed coil dynamos is thoroughly covered by a graphical study of the relation of the several variables involved. The laws of electromotive force generation and of armature reaction are elaborately discussed. Strangely enough, while a number of special but little used plans for preventing armature distorting effects are given, no mention is made of pole face and armature tooth saturation, which are now used practically to the exclusion of other methods. Series and shunt characteristic curves are shown, and a calculation illustrating the manner of applying the theory to an actual design is worked through. A summary of the subject of storage batteries and their application follows the dynamo chapters and completes the subject of parallel distribution. The chemical and the engineering features of storage batteries, especially in connection with electric lighting, are enumerated. The author discusses the uses of these as auxiliaries in isolated plants, in train lighting, and in central stations where they serve as sources of reserve energy as regulators of pressure.

The material on series distribution covers, of course, the circuits and generators for maintaining constant current for arc and for series incandescent lighting. The two open-coil American machines, the Thomson-Houston, and the Brush, are the only dynamos described, no mention being made of any closed-coil arc machines. The Ferranti system, consisting of a transformer for changing from constant alternating pressure to constant alternating current and then by means of a rectifier to a uni-directional current, is very interesting. As the pulsating current, which is also produced by the Thomson-Houston and the Brush machines, is well adapted to arc lighting the results of this practice must be satisfactory. The reader will ask why it is necessary to transform to direct current; the answer is that the satisfactory alternating current arc lamp is of recent development, although it will undoubtedly soon displace its older rival.

The generation of electric power next receives attention. As introductory to this subject the theory of alternating current control is covered at some length, after which the machinery used for producing alternating currents is described and illustrated. A number of cuts of well-known but peculiar machines gives to this part of the book a hackneyed appearance, as we miss the stately alternators of recent years. Transformers are treated at this point both historically and from the operating standpoint, and their importance as factors in the development of alternating current lighting is clearly set forth. Certain operating features of central stations are taken up in some detail. These include such subjects as coupling direct current generators and alternators in parallel, conversion of polyphase currents, and other such matters.

A considerable space is allotted to the manufacture of incandescent lamps, and to the construction and operation of arc and incandescent lamps of all kinds. Finally, a brief and necessarily incomplete chapter is devoted to central lighting stations and to the problems connected with them.

As a whole, the electrical section of the book impresses one as an attempt to do too much in a small space. The field is the same as that covered

by the two volumes of Crocker's "Electric Lighting," which is much more readable and is handier for reference. Crocker's book, however, relates to American practice and this part of "Chemical Technology" will enable a reader to compare electric lighting in the two countries, as it is a rather complete digest of the English aspect of the subject.

In the section on photometry the space is divided between descriptions of photometers and of standards of light. These matters are covered in considerable detail, and with a wealth of illustration. Following, as it does, a treatise on electric lighting we should expect to see the matter of electric light photometry discussed, but in this we are disappointed. The amount of work now being done in the direction of standarizing the methods of measuring and rating the candlepower of incandescent and arc lamps indicates the importance and timeliness of this subject. A chapter on commercial electric light photometry would add greatly to the value of this treatise. As a statement of the methods of securing and maintaining fixed standards of light the work is very complete for the space covered.

ELECTRICITY AS APPLIED TO MINING.—By Arnold Lupton, M. Inst. C. E., M. Inst. M. E., M. Inst. E. E.; G. D. Aspinall Parr, M. Inst. E. E., Assoc. M. Inst. M. E.; and Herbert Perkin, M. Inst. Mining Engr. London: Crosby, Lockwood & Son. New York: D. Van Nostrand Co. Cloth; 6 x 9 ins.; pp. 280; 171 illustrations. $3.50 net.

The growing importance of electric power in all lines of engineering work justifies this attempt to place in the hands of mine operators and students of mining a book which will give them the essentials of the science of electrical engineering. There are certain underlying principles of this subject which should be understood by all engineers, and the technical schools are gradually coming to realize the necessity of including courses for this purpose in their curricula. The matter should be presented by teachers familiar with the subject itself, and with its application to the various departments of engineering practice. In this work the joint authorship assures the reader of the accuracy of all phases of the treatment, for the writers are men who know the subject from different sides. They have succeeded in combining their contributions so that there is continuity in the discussion.

The matter which is purely electrical is of non-mathematical form and it begins at the foundation principles of the magnetic and other effects of the electric current. The fundamental units are defined in a manner satisfactory from the operator's standpoint, and with liberal use of mechanical analogies to make plain the nature of electrical properties and conditions. Rather a large proportion of the space is given to the primary battery and storage cells, and a relatively small amount to dynamos and motors. It is doubtful if it is worth while to attempt to give a reader an idea of the action of all alternating current motors in the space of three pages. It would have been better to have given the space to a statement of the engineering status of these machines. It is, however, very difficult to estimate the attitude of mind in which a reader will approach a book, and as the material is good, and the style clear, it is probable that readers not trained in electrical matters will derive as good a general idea of the subject as could be expected. The conviction is strong with the writer that all that a general treatment like the one before us can be expected to do is to inform the reader of the problems which must be met, and of the facilities available for meeting the conditions. When the problems are actually encountered, and then only, will the engineer have the necessary stimulus for making a more detailed study of the particular phase of the subject involved. His reading of the general work will prevent his falling into errors due to ignorance of the real nature of the problem, and he will consult special books, or if the matter is very important he will call into conference a consulting electrical engineer in order that the policy and the technical details shall be wisely determined upon. It is to be hoped that in a future edition the authors will include a carefully selected but brief bibliography of the subjects of electrical and of mining engineering for this purpose.

The uses of electricity in mining operations are in general for the supply of mechanical power for individual machines and for hauling, for lighting, for signals, blasting and other miscellaneous purposes. In the supply of power the electric current competes with steam in pipes, reciprocating rods, rope-drive, compressed air, high pressure water and gas or oil. It is preferred in many mines on account of the small losses in transmission, its flexibility, and the ease with which it can be generated. Attention is called to the fact that there is considerable fire risk connected with the use of the current if the plant is not properly installed. A mine is an especially hazardous risk, on account of the gases often present, the large amount of timber used, and the quantity of coal dust and of solid coal ready to take fire at any instant. There is always present a rapid circulation of air in the passages which fosters and spreads flame with terrible swiftness. Hence the blowing of fuses, opening of circuit-breakers, sparking at commutators, short-circuiting of cables, and all such sources of fire risk, must be either eliminated or kept from doing the harm which they would do if no special precautions were taken. For this reason the authors lay special emphasis on the methods used for reducing these risks. They describe the devices used to enclose the commutators of direct current motors, to prevent short circuits, and to reduce fire risk generally. They say:

> The mining engineer must treat electric generators, conductors and motors as if they were fires, because they may become fires. Having once made up his mind so to deal with electrical appliances, and having in consequence made the proper arrangements, it is probable that he will never have a fire, or any serious difficulty with his electric plant.

Beginning with the steam plant, all of the electrical machines used in mine work are described and illustrated. Prime movers are treated briefly, except in the case of the steam turbine, to which a chapter is devoted. Some data of actual results of operation of steam plants in coal mines are given. The electrical side of the power plant has a rather incomplete treatment, but mention is made of the essential features of such an equipment. Naturally, considerable space is given to the transmission line, including insulators, cables, pole line and fittings. Line economy is taken up for the purpose of enabling the engineer to select the variety of current and the pressure best suited to any case.

The most interesting chapters are those devoted to descriptions of the machines used for lighting, ventilating, pumping, hauling, coal-drilling and coal-cutting. We note that while electrically driven rope haulage plants are popular, the electric mine locomotive does not receive the same favor in England as it does in this country. A number of miscellaneous but important uses of the current are discussed, including blast-firing devices, electric safety-lamps, and signals of all kinds. As examples of the application of all of the principles laid down in the book, a number of descriptions of actual plants round out and complete the discussion. The work is written in good style, is well illustrated, and gives American readers the opportunity of comparing English mining practice in the application of the electric current with our own.

ELECTRICAL PROBLEMS FOR ENGINEERING STUDENTS.—By William L. Hooper, Ph. D., Professor of Electrical Engineering, Tufts College, Mass., and Roy T. Wells, M.S., Senior Fellow in Physics, Clark University, Worcester, Mass. Boston: Ginn & Co. Cloth, 6 x 8½ ins.; pp. 170, with diagrams. $1.25; by mail, $1.35.

The absorption of the principles of electrical engineering by a student is necessarily a slow process, and it must be accompanied by continual practice in the solution of problems. One of the most important duties of a teacher of this subject is the preparation of the problems, which must be so designed that the ground is covered systematically and in an interesting manner, but without requiring unnecessary labor on the part of the student, as the college course is already much crowded. The problems should develop fluency in the arithmetical and algebraic work, readiness to perceive underlying principles, and at the same time the student may be given a general idea of engineering proportions. Prof. W. L. Hooper of Tufts College and Mr. R. T. Wells of Clark University have published a set of problems which have been of use in their work. This collection represents a large amount of painstaking labor, as it contains a total of 609 problems, some of which are quite difficult. The examples cover the whole range of electrical engineering, from those illustrating the application of the definitions of units, to others which treat of the design and operation of rotary convertors, induction motors and other important electrical machines. To quote from the prospectus, the problems are divided into four groups as follows:

1. Twelve sets of problems and calculations on combinations of electromotive forces and resistances in series and multiple grouping; distribution and fall of potential in railway and lighting circuits, inductance of coils, capacity of condensers, thermo-electricity, electro-chemistry; and output and efficiency of batteries, generators, motors, etc.
2. Four sets of problems on combinations of alternating electromotive forces and currents and the impedance of circuits with constant and with varying values of resistance, inductance, capacity and frequency.
3. Five sets of problems on calculating and making winding tables and drawings for direct and alternating current armatures, armature reactions, field windings, etc.
4. Problems on winding and operation of transformers, rotary converters, and induction motors; and on testing of dynamos and transmission of power.

The work is more than a collection of problems, as each set is preceded by a brief statement of the laws and principles which the group is intended to illustrate. For example, at the head of the chapter on Armature Reactions a page is given to an explanation of the manner in which the armature tends to demagnetize the field. Following this is a series of ten problems in the statements of which much valuable engineering data are given. Several alternating as well as direct current machines are thus treated. This plan is most excellent and conforms closely with the requirements of the ideal problem as outlined above.

The book is copiously illustrated, a very commendable feature being the collection of diagrams given in the appendix, which show graphically the results of the solutions wherever this is practicable. These will be suggestive to the student, who should, in working out the examples, produce such graphical solutions in conjunction with his algebraic and arithmetical work. These illustrations may be free-hand and rough in execution, but the graphical will be a check on the arithmetical solution, and will guard him against the danger of dissociating the physical facts and the methods used for solving the problem. As many of our modern methods involve certain artificial assumptions, the importance of following this plan is obvious.

The authors use throughout the work the names of the units which are recommended by the American Institute of Electrical Engineers. This is a wise step, for it is through text-books and classroom instruction, as well as through the periodical engineering literature, that these reforms must be largely brought about. Hence we are pleased to find the newer names, inductance, resistivity, maxwell, gauss, and others used in place of the older and less logical terms.

While reference works on electrical engineering subjects are increasingly plentiful and satisfactory, electrical text-books are rare and some of these are incomplete. It is therefore safe to say that a book like the one before us, built upon experience and true to the best pedagogical principles, will be welcomed by teachers and students who have felt the want of just this sort of thing. In a course of instruction it would fitly accompany one or more of the analytic and descriptive text-books, or it would make an excellent adjunct to a course of engineering lectures. It contains about enough material to furnish work for three or four recitations per week for a year in the junior or senior class of a technical college.

HOW TO BECOME A COMPETENT MOTORMAN.—A Practical Treatise on the Proper Method of Operating a Street Railway Motor Car; also giving Details How to Overcome Certain Defects. By Virgil B. Livermore, Chief Instructor, and James Williams, Shop Foreman, Brooklyn Rapid Transit Co. New York: D. Van Nostrand Co. Cloth; 4 x 6 ins.; pp. 232; illustrated. $1.

As the title indicates, this work is planned to instruct motormen and prospective motormen in the methods of operating and caring for the apparatus connected with a modern street railway

car. It is written by men who are responsible for the proper instruction of motormen, and who are also familiar with the maintainance and repair of motors, controllers, brake outfits and other parts of a car equipment. No attempt at literary style is made, but the method of treatment is simple and direct. In part the matter takes the form of empirical instructions to motormen as to the manipulation of the operating devices of the car, such as the controller and the brake equipment. Very wisely there is no attempt made to give an elementary treatise on electricity in general, a plan used by many authors to pad out what would otherwise be very thin books. Considerable space is occupied by a series of questions such as would naturally be asked by a practical railway man of one who was to be trusted with the care of such a highly organized piece of machinery as a modern street railway car. The answers to these questions are definite and reasonably complete. These should be helpful to those for whom the book is intended, in enabling them to test their knowledge of the information given. Clear diagrams would greatly increase the usefulness of this little work, as the illustrations are few in number and poor in quality, but otherwise the general make-up of the book is creditable, and its size is such that it can be conveniently carried in the pocket.

Athens Ancient and Modern.

THE STORY OF ATHENS.—By Howard Crosby Butler, Lecturer on Architecture in Princeton University. New York: The Century Co. Cloth; 6 × 8 ins.; pp. 532; 130 illustrations. $2.40 net.

ANCIENT ATHENS.—By Ernest Arthur Gardner, Yates Professor of Archaeology in University College, London. New York: Macmillan & Co.. Half leather; 6×9 ins.; pp. 579; folding maps, photogravure plates and illustrations in the text. $5 net.

No one familiar with municipal conditions in America can read these books without being impressed with the great contrast between both ancient and modern Athens and the cities of this country. Century after century public officials and private citizens devoted themselves to the esthetic betterment of the Greek city. In this country it is rare, indeed, to see municipal officials giving serious and continued attention to the artistic development of their city. A few private individuals, here and there, have sought to adorn the city of their birth or adoption by some public building, statue, or monument; but too often such efforts, though well intentioned, have been sadly misdirected. In recent years, fortunately, such organizations as the American Institute of Architects, American Park and Outdoor Art Association, and the American League for Civic Improvements, have tried to arouse and unite the forces that are or may be made interested in the city beautiful. To all such people, and to municipal officials and others desirous of working to the same end, "The Story of Athens," and "Ancient Athens" are commended. Of course both books appeal to a wide class of readers who will be interested in them for other reasons, but it seems desirable to emphasize the possible bearing of the volumes upon municipal art.

For inspiration and for entertainment Professor Butler's "Story of Athens" promises more to the majority of readers than does the other book; for, as its title states, it is a story of the great and never-dying Grecian city. Art, including literature, oratory and music, is given preëminence throughout, but its development at Athens is told in conjunction with the growth and decline of commerce, war, politics, and philosophy. Such a plan gives a meaning and life to a narrative that is otherwise difficult if not impossible. But, on the other hand, it encourages digression and, where there are many gaps in the history, ingenious and hyperbulous assumptions, more amusing than instructive. Yielding to such temptations, it has been suggested, is one of the faults of Professor Butler's interesting book. It is only fair to add that where facts are available the author does not draw upon his imagination, and that he gives continuous evidence of being a thorough master of Grecian art and archeology.

From what has preceded it may have been inferred already that "The Story of Athens" is a continuous narrative, from the earliest times to the close of the nineteenth century, of the life and art of the city, its military conquests and defeats, its greatness and downfall as a nation, and finally its slow, painful, but steady upbuilding in the present century.

Architects and engineers will appreciate the carefully drawn pen sketches which abound throughout the book. As to his mode of illustration the author observes:

> I have chosen to represent the monuments of architecture by means of line-drawings, in order to overcome the exaggerated perspective of photographs, and to do away with their deceptive color scheme, by which the golden-yellow marble of the ancient buildings is made to appear brown or black against a white sky. The sculptures are reproduced almost entirely by photograph.

Professor Gardner has chosen photogravure plates and half-tones for nearly all his illustrations, other than maps and plans. Without going far into the merits of his method of illustration, as compared with pen sketches, it may be said that the reproductions of photographs will appeal more forcibly to many people than will the pen sketches, and that those who secure both volumes will be glad that different modes of illustration were chosen for the two books. The photogravures in "Ancient Athens" are in themselves works of art, and many of the half-tones are of a high order. Some of them are rather flat, and compared with the pen sketches in the other book, give force to Professor Butler's remarks.

In his opening chapter, Professor Gardner considers, all too briefly for an engineer, the water supply of the ancient city. He also describes the building materials in and about Athens. He then takes up the walls of the Acropolis itself, the town before the Persian wars, and early Attic art. Some of the chapters are devoted wholly to one building, as in the case of the one on the Parthenon. Others consider several buildings, and still others survey a period, like the chapter on "The City in the Fifth and Fourth Centuries." This plan, combined with a restriction of subject almost wholly to architecture, and other phases of art, makes Professor Gardner's work more complete and instructive on art matters than is possible in a volume like Professor Butler's, on Athens in all her varied aspects. For the art student, "Ancient Athens" might be preferred: for the general reader, or for the art student not otherwise provided with information regarding the life history of Athens, "The Story of Athens" has decided advantages. Of course the art of Athens cannot be fully appreciated without a knowledge of the daily life of the people, and of the history of the city. It is on this account that Professor Butler's narrative is to be highly commended, particularly as it is one of the few comprehensive attempts at such a combination which has ever been made.

WALL PAPERS AND WALL COVERINGS.—A Practical Handbook for Decorators, Paperhangers, Architects, Builders and House Owners. With many Half-Tone and other Illustrations Showing the Latest Designs.—By Arthur Seymour Jennings, Editor of the "Decorator," Honorary Consultative Examiner to the City and Guilds of London Institute in Painters' and Decorators' Work. New York: William T. Comstock. Cloth; 7 × 11 ins.; pp. 161; colored and other plates, and illustrations in the text. $2.

This book is written from the practical and commercial point of view, but shows no small degree of appreciation of the artistic phases of the subject. There is a chapter on the selection of wall papers to suit the requirements of various rooms. English, American, and French wall papers are then briefly described in turn, and the different varieties of papers are defined. A chapter is devoted to tools for paper hanging, and there are chapters on hanging paper, on ceiling decorations, on a number of other wall coverings besides paper, including burlaps, Lincrusta Walton and the like, and on draperies, silks, cretonnes and tapestry. There are numerous half-tone illustrations of wall papers of American and foreign make, besides some line drawings and other illustrations of paper hangers' tools. One of several short appendices is devoted to the use of stencils for decoration. The book seems well calculated to serve the purposes of the master paper hanger and decorator, and contains many hints for architects, builders, and house-owners.

A New and Enlarged Edition of the French Engineers' Handbook.

NOTES ET FORMULAS DE L'INGENIEUR.—By a Committee of Engineers, Under the Direction of Ch. Vigreux, Engineer of Arts and Manufactures; Ch. Milandre, C. E., and R. P. Boquet, E. E. Thirteenth Edition, Revised and Enlarged. With a Technical Vocabulary in French, English and German. Paris: E. Bernard & Son. Cloth; 5 × 7 ins.; pp. 1,752; 1,300 illustrations. $3.50 net.

This book is intended to serve the same purpose in France as do Trautwine's, Kent's, Foster's, Haswell's and Kidder's pocket-books in America, but whereas the American books divide the engineering field between them, each confining itself to one or a few branches of engineering work, the French book covers the whole field. In this respect it resembles the German "Hütte" or "Des Ingenieurs Taschenbuch" reviewed in our issue of Feb. 19. The French book is published in two forms, one a dumpy volume 4½ × 7 ins. × 3½ ins. thick, on heavy paper, and the other a thin paper volume of pocket-book size. In make-up and typography it is generally inferior to the German "Hütte," and also to the American pocket-books with which it is most nearly comparable in size and scope. It is only right to state, however, that the publishers announce their intention of resetting the type and improving the whole make-up of the next edition. It should perhaps be noted further that the present edition is the thirteenth, and that 80,000 copies of the twelve previous editions have been sold.

The new edition of the book which is before us has been revised and enlarged. Altogether the additions amount to about 500 pages. The revision in some parts amounts to a practically new writing of the chapter. We note, for example, that the chapter on electricity has been entirely rewritten, and the chapters on power-transmission and hydraulics largely so. The most notable of the additions are the chapter on mining engineering, which occupies over 200 pages, and a section of about 30 pages on automobiles. About 100 pages are devoted to mathematics, including arithmetic, geometry, algebra and trigonometry. These are followed by long sections on mechanics and mechanisms, boilers and engines, and hydraulics. There are also sections devoted to gas engines, ventilating and refrigerating machinery, hoisting machinery, pumping machinery, heating, gas manufacture, bridges and structures, paper manufacture, brewing, distilling, and sugar manufacture. About 100 pages each are devoted to metallurgy, railways and electricity. The volume concludes with a technical dictionary in French-English-German, English-French, and German-French, and with an elaborate index.

A SYSTEMATIC METHOD OF CALCULATING THE DIMENSIONS OF DIRECT-CURRENT DYNAMO-ELECTRIC MACHINES.—By Carl Kinsley, Instructor in Physics, University of Chicago. From Vol. IX., The Decennial Publications. Chicago: University of Chicago Press. Paper; 9 × 11 ins.; pp. 14; one illustration, 25 cts. net; by mail, 28 cts.

The author arranges in logical order the various equations giving the necessary conditional relations between different dimensions and properties of direct-current dynamos. In designing a dynamo, it is desired to construct a machine giving current at a certain potential, and able to supply a certain amount of current without overheating; the general form of the machine, as to arrangement of armature, and the like, is one of the known quantities, as is also the velocity of revolution; the latter very naturally being made as great as the materials will stand. The dimensions of a machine to satisfy these conditions, the losses, and the material used are all involved in complex relationships which cannot well be mathematically expressed. It is therefore not possible to make a direct mathematical solution, but various relations must be assumed, the designer being guided by past experience. Thus, a table of electrical efficiencies for certain values of output, according to good practice, may be used as a guide. This, in fact, is done by the author, who from this table selects an efficiency sanctioned by commercial practice; with this as a first assumption he brings together the equations for determining the leading dimensions of the machine, connecting them where necessary by further assumptions from practice.

A Pioneer Treatise on the Art of Illumination.

THE ART OF ILLUMINATION.—By Louis Bell, Ph. D. New York: McGraw Publishing Co. Cloth; 6 × 9 ins.; pp. 345; 127 illustrations. $2.50.

This is a first book, since there is nothing in existing literature that treats of the efficiency, or rather effectiveness, of lighting. Yet we are inclined to believe that the book will long be a standard of reference on its subject. This is said in reference to the engineers' interest in the book; but the author has produced a work adapted to serve wider circles than those concerned with engineering. And in fact the greatest need for much or most of the information presented, exists among the civilized public at large. For in nothing is the average man so ignorant as in the matter of his eyes, the light that reaches them, and their proper and improper relationships. Who has not done half an hour's reading in unsuitable light and stopped because of a rising headache? Yet how few there are who properly connect the cause with the effect!

An outline of the contents of the book may be of interest. The first three chapters are a general discussion of the physics of light and its physiological effects upon the eye, as far as they affect illumination. The first chapter, on Light and the Eye, calls attention to some matters like intensity of light, quantity of light, and intensity of illumination, variable or flickering light, retinal fatigue Color is discussed in the second chapter, the physical side alone being represented; .mixtures of colors, relative intensities, etc., are treated of. The fact that light rarely enters the eye directly from a primary source makes Chap. III., on Reflection and Diffusion, of great importance to an understanding of illumination. Diffuse reflection, selective color reflection, multiple reflection, etc., are both helpful and obstructive to our efforts in providing an artistically and physiologically good artificial illumination in a room.

Four chapters then follow that deal with the materials of illumination. The different illuminants and the means of applying them are briefly described and various items of information are given that concern their lighting value. The first of these chapters is given up to oils and gases, and the lamps, etc., for burning them; there is little auxiliary information. The next chapter describes the Welsbach mantle burner, which the author thinks deserves wider use than it now enjoys. Chaps. VI. and VII. deal respectively with electric incandescent and arc lamps, and these chapters are quite exhaustive in giving curves of light distribution, tables of temperatures and efficiencies, life, uniformity, etc. The chapter on the incandescent lamp treats also of the Nernst lamp.

Chap. VIII. gives data on the diffusing power and the light absorption of many different forms of lamp shades and reflectors, which, as is explained, are necessary auxiliaries in illumination to get a satisfactory distribution of light.

The following three chapters are among the most helpful in the book. They treat in a practical way the problems that arise in lighting, respectively, dwellings, large interiors, and exterior spaces. In Chap. IX. the lighting of a dwelling is worked out; the size of the different rooms and the style of interior finish being known, the number, arrangement and power of the lights is calculated, such as to give the desired illumination, general and local. The problem is worked out in the main for electric incandescent lamps, but the changes required for the case of gas are indicated. In connection with this chapter it is worth while noting that the author accords oil-lamps a higher value than does the present-day mode in interior lighting; he says:

> While these lights (gas and electric incandescent) are the ordinary basis of illumination wherever they are available, lamps and candles, which can be put where they are wanted and not necessarily where some irresponsible workman chose to locate them, are often most useful additions to our resources.

Chap. X. covers interiors like ball-rooms, theatres, and halls, and several problems are worked out. Chap. XI., in which the lighting of exteriors is considered, is devoted entirely to street lighting; the distribution of light from arc lamps is thoroughly considered, and the spacing to give certain desired minimum illumination. The cost of lighting is also taken up. The next chapter discusses "Decorative and Scenic Illumination," which covers the "electric sign" style of lighting where the lights do not really illuminate but are to be looked at directly, miniature lamp work which is often true illumination, and searchlight work, which in all cases is true illumination. An interesting chapter is the thirteenth, on the "Illumination of the Future." Vacuum tubes or vapor lamps, radiations similar to those from radium but giving luminous waves, and artificial phosphorescence are speculated on as light sources, while lighting by diffusion, an extension of "concealed lighting," is considered quite probable as a wide development of the future.

The last chapter treats briefly of standards of light, of photometers, and of the illuminometer.

As already suggested, the book contains much valuable matter, matter that has never before been brought together. But this will be clear from our outline. Of the specially good things, we would mention many scattered sentences or fragments in which the author has really epitomized whole chapters, and which convey much suggestion and stimulus. Here are one or two of them:

> Illumination is not a science . . . but an art wherein an indefinable and incommunicable skill pertains.
>
> The general tendency with the modern intense radiants is to light too brilliantly.
>
> A tallow candle just where it ought to be is better than a misplaced arc lamp.
>
> Since the introduction of electric lights that very facility of application which gives them unique value has encouraged more zeal than discretion in their use.
>
> More study of the practical conditions of lighting and less blind faith in bright lights would generally both improve practical illumination and tend to economy.
>
> A great deal of time and effort has been wasted in this world in the promulgation of so-called "absolute" standards.
>
> Such fixtures (cut glass lamp shades) logically belong over an onyx bar inlaid with silver dollars, and to that class of decoration in general.

What grudge has the author against onyx bars?

There are fewer matters to disapprove in this than in most books which touch a new field. Yet a word or two of criticism may not be out of place. On the first page the author divides his subject into two parts: (1) Illumination proper, and (2) Scenic or decorative illumination, "designed to produce particular effects or illusions." As examples of the latter he cites lighting a picture gallery or the stage of a theatre. We submit that both of these are examples of ordinary illumination, where a source of light is arranged so as to throw light on something which is to be rendered visible. So is a searchlight, or a stage projector. On the other hand, when the frontispiece shows a theatre en fete, with festoons and coats-of-arms, built up of electric incandescents, or when the Pan-American buildings are shown, with their entire exteriors thickly studded with lamps, then we have before us examples of true "scenic" or "decorative" lighting. But if this is true, why should "decorative" lighting be included in the present book? The general discussion of Chaps. I. to III. is not patent to it, nor is the treatment of lighting problems as given in Chaps. IX. to XI. It is connected with other lighting in only one way—because it employs lamps; but it does not illuminate, nor is its study the province of anyone but the architect.

The views of antique fixtures, in Chap. IX., might better have been omitted; they seem to have no bearing on the subject. In a rather different manner the author steps out of his way, on pp. 268 and 269, to discuss private vs. municipal lighting plants for public lighting. Many of the illustrations in the book are not very satisfactory; among these the spectra shown in black and white, on pp. 25 and 26, would convey much more information if they were drawn as curves with intensity of light as ordinates and wavelengths as abscissas. Finally, if we may venture a suggestion in place of a criticism, would not some discussion on "daylight lighting" of buildings, i. e., by windows and skylights, be in place in a book like the present? The designer of a shop building, for example, only too rarely has any clear idea as to how much lighting area to provide or how to distribute it; and only too many existing shops and factories are caves of darkness, if not at first, then at least after the machinery, etc., is in place.

HIGHWAY CONVENTION OF THE STATE OF NEW YORK.—Proceedings of the Fourth Annual Convention of Boards of Supervisors, at Albany, Jan. 20 and 21, 1903. Albany, N. Y.: Department of State Engineer and Surveyor. Paper; 6 × 9 ins.; pp. 81; illustrated.

This bulletin contains speeches, tables of road mileage in New York state, and like matter presented at a meeting of representatives of the Boards of Supervisors of the minor civil divisions of the state.

German Tables for Railway Curves.

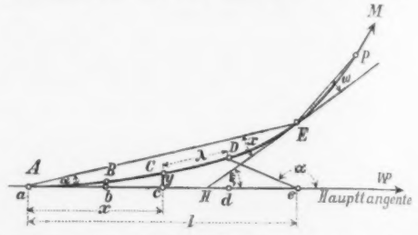
TAFELN ZUM ABSTECKEN VON KREIS UND UEBERGANGS BOEGEN DURCH POLAR KOORDINATEN.—By Max Pernt, Assistant Engineer, Austrian State Railways. Vienna: A. Hartleben. Cloth; 5 × 7½ ins.; pp. 129; 12 illustrations. 3.6 marks; in the United States, $1.10.

As the title of this book tells, it is a collection of tables for laying out railway curves, circular and transition; about half the book is devoted to each kind of curve. The expression "abstecken durch polar koordinaten" means laying out by deflections. A preliminary table gives the deflection angle in seconds and five decimals for a length of arc equal to 1 m., for radius of curve varying from 5 m. to 5,000 m. The table for circular curves, which follows, gives deflection angles in degrees, minutes, seconds and tenths, for lengths of curve from 0.1 m. to 100 m., for radii from 50 m. to 5,000 m.

The tables for transition curves are based on a curve

$$y = \frac{x^3}{6C},$$

and cover curves having values of the constant, C, as follows: 12,000, 6,000, 4,500, 3,000, 1,500 and 750; the curve for C = 20 R was also calculated, as that curve is much used in Germany. The quantities given by the tables are as follows: Re-



ferring to the accompanying cut, A E is the transition curve, E M the main curve, whose radius is R. Then, the instrument being set at a, the deflection angles B a W, C a W, D a W and E a W are given, for the points B, C, D and E which have abscissas equal to ¼, ½, ¾ and $\frac{4}{4}$ of the abscissa length l of the transition curve. The same angles are given for the instrument set at b, the point on the tangent distant ¼ l from a; that is, the angles B b W, C b W, etc. Similarly the deflection angles for instrument at c, d and e are given. The angles ξ and x, the distance v between the main tangent and the parallel tangent to the circular curve, the values l, △ (the excess of curve length over the simple curve), etc., are given, and the coordinates x and y of the points B, C, D and E. There is a separate table for each value of the constant C, and each table covers ten to twenty values of the radius R. The method of staking out the transition curve by these tables will be clear from the above mention of the quantities given.

INDEX OF WOOD-WORKING MACHINERY AND ACCESSORIES.—Section B of the Mechanical Index. An Encyclopedia and List of Manufacturers in the United States of Mechanical Appliances and Tools Operated by Steam, Electricity, Water, Air, Hand or Foot Powers. New York: The Industrial Press. Paper; 6 × 9 ins.; pp. 461. $1.

The "Encyclopedia" feature of this classified directory is very meager, but occasionally it might serve a very useful purpose to the uninitiated. In the case of some little-known special appliance. The arrangement of names of manufacturers under the several headings is alphabetical, and perhaps would be more useful if it was geographical instead. Cross-references are used, and there is a general index, with key numbers for the several classes, which latter are in numerical order. The plan of publishing a manufacturers' directory in sections, by leading industries or appliances, is commendable, because convenient and economical for purchasers.

Mechanics of Machinery, with Special Reference to the Steam Engine.

MECHANICS OF MACHINERY.—An Elementary Treatise, with Special Reference to the Mechanics of the Steam Engine. By Joseph N. Le Conte, Instructor in Mechanical Engineering, University of California. New York: The Macmillan Co. Cloth: 5 × 8 ins.; pp. 311; 15 plates and 211 figures. $2.25.

The preface states that this book is the outcome of a course of lectures on Kinematics and the Mechanics of the Steam Engine, which has been issued in the form of notes to students in the Department of Mechanical Engineering of the University of California for several years past; the real purpose of the work being the application of the principles of mechanics to certain problems connected with machinery. "No special originality is claimed for the major part of the material."

The scope of the book is shown by the following brief synopsis of the chapter headings and subdivisions: An introductory chapter of 16 pages deals with kinds of motion, instantaneous center, centroids and determinations of relative lineal velocities. Four chapters on transimission of pure rotation then follow: (1) Transmission through a rigid intermediate member, such as journals and bearings, parellel bars, cranks, Oldham's coupling, universal joints, 11 pages. (2) Friction wheels, 3 pages. (3) Transmission through belting and ropes, including leather belting, stepped cones and wire rope, 31 pages. Transmission by hemp and cotton rope seems to be omitted. (4) Transmission by toothed gearing, including spur, bevel, skew, bevel and hyperboloidal gears, 75 pages, or nearly one-quarter of the whole book.

A brief chapter on different kinds of straight line or parallel motions, and a still briefer one on cams conclude the first half of the book. The second half is devoted to the steam engine, and it is divided into two parts, kinematics and dynamics. Under the first head we have 18 pages on the piston-crank chain, with the relation of the position of the crank to the position, the velocity and the acceleration of other parts of the chain, and 41 pages on valve-gearing. Dynamics of the steam engine occupies 57 pages, and includes a treatment of the forces due to the pressure in the cylinder, inertia effects of the reciprocative parts, the flywheel and governors. An appendix of 21 pages contains a mathematical treatment of some of the more abstruse problems in mechanics referred to in the body of the book.

This brief summary of the contents of the book shows that the author has attempted to cover a great deal of ground in one small book. The book itself is evidence of a "long-felt want" of a thoroughly good series of text-books to be used by the student in his engineering course, and afterwards preserved as works of reference. For the lack of such books it is the custom of many professors in engineering schools to prepare courses, gleaning their information here and there from such literature as they find available. Later they issue "notes" of these lectures usually printed by a hektograph or other cheap duplicating process, and then finally revise these notes and put them in the form of a book like the one before us. The result is a new crop of books every year, which are no better, and in many cases not as good, as the books which have preceded them. The present work is an example of a method of book making which should not be encouraged. The greater part of the matter in it can be found in better shape in other books, and what little there may be that is new in it is not good.

Of what appears to be new we notice especially a method of plotting the diagram of a steam engine and calculating the horse-power. The author says:

> Steam is admitted into the head end of the cylinder, and as the force exerted by the steam upon the piston is towards the origin 0, or in the left, this pressure is negative, and is laid off below the axis of x.

He then shows a diagram from the crank end of the cylinder in the usual shape and position with reference to rectangular co-ordinate axes, together with another diagram, from the head end, turned upside down and laid off below the axis of x. He then plots two new diagrams, showing the net pressure at each part of the stroke for both ends, and adds the areas of these two diagrams together, although one is called negative and the other positive, and thus obtains by a roundabout method the sum of the areas of the two indicator cards, which might have been obtained much more directly by the usual method. He further says the "curves of net horizontal steam effort are particularly useful in the analyses which follow" and these analyses lead up to a new formula for horse-power:

$$(P_m + P'm)\ L\ N \div 33{,}000,$$

in which P_m and $P'm$ are the mean total pressures acting on the piston in the two ends of the cylinder; L, the stroke in fact, and N the revolutions per minute. If "specific pressures are employed the area of the piston will enter as a constant factor on the right side of the equation." This, we submit, is an unusual use of the word "specific," and the formula is not likely to be used in practice in place of the well known one, P L A N ÷ 33,000, which is not found in this book.

The first half of the book is too brief and fragmentary to be a satisfactory treatment of the subject of kinematics of transmission machinery; its method is severely mathematical, trigonometrical formula being used throughout, when graphical analysis would be clearer, and it is almost entirely lacking in concrete examples from practice. The half of this part which is devoted to gear wheels is fairly good so far as it goes, but a fuller and better treatment of the subject can be found in other books. The second half, relating to steam engines is open to the same objection. The portion devoted to valve gearing, 41 pages, is entirely too brief to contain a thorough exposition of the subject, such as is given in numerous books on valve gears, and that devoted to dynamics of the steam engine is much better treated elsewhere.

We notice some cases of hasty proof-reading, such as the misspelling of combination on p. 1, the indiscriminate use of z and Z on p. 107, an apparent error in the heading of the table on p. 108, the expression "draughted teeth" on pp. 81 and 89, without explanation of what is meant by the term, the word "no" for "an" and "above" for "on the next page" near the bottom of p. 81. On pp. 38 and 39 the value of the same quantity, α, is given as 180° and π.

The Purification of Boiler Feed Water.

EXPURATION DES EAUX.—D'Alimentation de Chaudières et Désincrustants. By A. Taveau, Engineer of Arts and Manufactures. Paris: Gauthier-Villars. Heavy paper; 5 × 8 ins.; pp. 158; 19 illustrations. 3 francs; in the United States, 90 cts.

The purification of boiler feed water is a subject of undoubted interest to engineers, and there is every reason to believe that an authoritative treatise on the subject would receive a warm welcome from them. This book cannot pretend to be such a treatise, but is nevertheless a well written and instructive little volume, and should prove of use to many. The processes and apparatus described are, naturally, French, and this decreases to some extent the value of the book to American readers, but on the other hand it gives the American reader an insight into the methods adopted by French engineers to solve a problem which is common to both, and in the respect it is of much interest.

In the first four chapters the author considers first the scale forming salts carried by natural waters; the chemical reactions which these salts undergo in the formation of scale, and by which scale preventing salts act to neutralize the tendency to the formation of scale; the methods of analyzing boiler water to determine its scaling properties, and to devise the means and extent of purification required, and the reagents employed in conducting this purification. The succeeding five chapters are devoted to the discussion and description of different purification processes and apparatus. Chemical processes, physical processes, and mixed or combined chemical and physical processes are considered in order. In Chap. X the author discusses the characters and use of scale-preventing compounds or boiler compounds as they are commonly termed in America. There is a final chapter on the pitting and corrosion of boilers caused by impure water and an appendix giving the rules of the Parisian Association of Proprietors of Steam Plants for the cleaning of boilers from scale. A bibliography of books and articles relating to the purification of boiler feed water concludes the volume.

A Plea for the Land Treatment of Sewage.

NATURAL AND ARTIFICIAL SEWAGE TREATMENT.—By Lieut.-Col. Alfred S. Jones, V. C., Assoc. M. Inst. C. E., and H. Alfred Roechling, M. Inst. C. E. London: E. & F. Spon. New York: Spon & Chamberlain. Cloth; 6 × 9 ins.; pp. 96; tables. 3½ shillings, net; in the United States, $1.40, net.

These admirable essays are more needed in England than in America, for here there has been no such craze over so-called bacterial processes as there has been abroad, nor does every American rush to the patent office whenever he thinks he has a new idea on sewage treatment. Taken together, the two essays might be described as a plea for a thorough consideration of the relative merits of land treatment as compared with the much-exploited septic tanks and rapid filters, the advocates of which seem to have taken England by storm, and who have made no little commotion in this country.

Colonel Jones, in about one-fourth of the volume, states the case for properly conducted sewage farms, basing his claims very largely upon his own experience at the Aldershot military camp, and at Wrexham, in North Wales. He also sets forth what seem to him to be the uncertainties and imperfections of septic tanks and rapid filters.

Mr. Roechling reviews pretty nearly the whole subject of sewage treatment, but has little to say regarding chemical precipitation, and says little or nothing bearing directly upon intermittent filtration, as practiced in Massachusetts and elsewhere in this country. He sketches briefly the history of sewage treatment during the past century, defines the various processes now in vogue, and devotes a considerable amount of his space to a discussion of the physical character and to the natural life of the soil, in their relations to sewage purification. He discusses briefly the septic tank and the various types of rapid filters, and also the leading features of land treatment, or sewage farming, all from the viewpoint of principles involved and results achieved. Some of the many recent English experiments with so-called bacterial processes are briefly discussed, and it is urged that the conclusions reached are for the most part local, rather than general, in their application. Finally, he sums up his own conclusions regarding natural and artificial treatment, or land treatment and the use of septic tanks and rapid filters, as follows:

Results to be obtained from:

(A) Natural Treatment.	(B) Artificial Treatment.
1. Removal of suspended matters.	1. Removal of suspended matters.
2. Removal of from 75 to 95% of the dissolved organic matters.	2. Removal of from 50 to 75% of the dissolved organic matters.
3. Removal of pathogenic organisms.	3. Nil. Effluent bacterially practically raw sewage.
4. Utilization of large portion of manurial elements.	4. Nil. All manurial effluents escape into the rivers.
5. Great reduction of quantity of liquid.	5. No appreciable reduction of quantity of liquid.

From the foregoing outline of the contents of this little book we think its interest and value to all who wish to master the subject of sewage purification will be apparent. It may be added that the book is well written, that the type is large, and the press work good.

THE EDUCATIONAL SERIES OF ROCK SPECIMENS.—U. S. Geological Survey, Washington, D. C. Paper; 6 × 9 ins.; pp. 400; illustrated. 25 cts.

While written primarily to explain each of the educational series of rock specimens distributed by the U. S. Geological Survey, this bulletin is well worth its price to any one interested in rocks. It is, in fact, a hand-book on rocks, and is moreover well indexed so that it makes a good book of reference. The bulletin is edited by J. S. Diller, but many of the specimens are described by other geologists.

TESTS OF REINFORCED CONCRETE BEAMS.—By W. Kendrick Hatt. Reprint from "Proceedings of American Society for Testing Materials." Paper, 6 × 9 ins.; pp. 20; illustrated.

This paper was printed in full in Engineering News of July 17, 1902.

Statics for Students.

Reviewed by Henry S. Jacoby,* Assoc. Am. Soc. C. E.

STATICS BY ALGEBRAIC AND GRAPHIC METHODS.—Intended Primarily for Students of Engineering and Architecture. By Lewis J. Johnson, Assoc. M. Am. Soc. C. E., Assistant Professor of Civil Engineering in Harvard University. New York: John Wiley & Sons. Cloth; 6 x 9 ins.; pp. 133; 42 illustrations. $2.

According to the preface, this book is intended primarily for students of engineering and architecture, to help them acquire a knowledge of statics that will include the power to apply it correctly in professional work.

The first part, covering 71 pages, deals with the general principles and methods, while the second part relates to their applications. The introduction contains a brief statement of the characteristic features of the algebraic and graphic methods and of their respective advantages. After giving the definitions, preliminaries, notation and conventions, the treatment of the parallelogram of forces is followed by that of the polygon of forces, and of the equilibrium of the string polygon. Next follow algebraic and graphic statements of the conditions of equilibrium with some applications in the composition of forces and in the establishment of equilibrium. In the solution of the four most important of the 29 cases of statical problems, the author applies the algebraic and graphic methods side by side, all the details and results being recorded on the folding plates. In following this plan the student not only checks his own work but gains the decided advantage of a larger and clearer view of the problem by the double solution. These plates cannot fail to impress upon the student the importance of a systematic arrangement of his work, and of the recorded results, and it would be well if this feature of reports and written exercises received more encouragement from teachers generally.

In the second part of the book, the applications refer to centers of gravity, moment and shear diagrams, and the determination of stresses in framed structures. Comparatively little space is devoted to the solution of any examples in this part, but many suggestions are given showing how to deal with special difficulties in finding the stresses in a number of typical cases of roof trusses, and in a few bridge trusses.

Thirty-two well-selected and graded exercises or problems are inserted for solution by the student. The scope of the work, while confined to statically determinate structures, is further limited by omitting stresses due to moving loads, except to state the steps involved and to refer the student to standard text books treating that subject. The lack of an index is made up in part by a very full table of contents, which gives the titles of the 92 sections, as well as of the 13 chapters.

OFFICE-COPY BOOKLET.—By Pence & Ketchum, authors of "Surveying Manual." New York: Engineering News Publishing Co. Heavy tagboard cover; 4½ x 7¼ ins.; pp. 32; ledger paper; columns on left-hand page, and squares for sketching on right. $1.00 per dozen, or 50 cts. per half dozen.

This booklet has been issued, primarily, for use in connection with the authors' "Surveying Manual" which has now been adopted by a majority of the leading technical schools of the country. This Manual urges the habitual keeping of good field-notes by the student in field work from the very beginning, and these booklets have been prepared with a view to assist in carrying out this standard. While intended primarily for office copies of student field notes and calculations, the booklet may also be used very effectively in assigning work to a number of isolated field parties, where it is desired to have the notes submitted at the close of each day's work, without depriving the student of his own field note book. It has also been found to serve well as a substitute for the usual bound note book of 60 to 80 pages; and in the end a series of booklets containing related matter can be bound temporarily by gluing them together near the back edge, or if desired they may be bound up in regular form.

While issued with special reference to the needs of the field classes of technical schools, these booklets are also well adapted to the miscellaneous needs which arise in the work of most engineers, such, for example, as when one or more field parties are to make daily reports or office copies of field notes so that the plotting may proceed in the office simultaneously.

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A Misnamed But Good Book on Differential Calculus.

Reviewed by E. Sherman Gould,* M. Am. Soc. C. E.

DIFFERENTIAL CALCULUS FOR BEGINNERS.—By Alfred Lodge, Professor of Pure Mathematics at the Royal Indian Engineering College, Cooper's Hill. With an Introduction by Sir Oliver J. Lodge. London: Geo. Bell & Sons. New York: The Macmillan Co. Cloth; 5 x 7 ins.; pp. 278; illustrations. $1 net.

This volume forms the latest addition to the "Cambridge Mathematical Series," and is also the latest addition to a branch of mathematical literature which has become exceedingly voluminous within the last few years, and which is devoted to the task of reducing the calculus to the plane of elementary mathematics—"Calculus made easy," in short.

When a persistent effort is made to furnish a steady output of any article it may be taken for granted that there is a market for that article, and the fact that for the last ten or fifteen years there has been a marked increase in the number of books bearing such titles as "Easy Lessons in Calculus"; "Calculus for Beginners"; "Calculus for Engineers"; "Primer of the Calculus", proves that there is an increasing thirst for the kind of knowledge that these titles lead the purchaser to expect.

Who are the purchasers of these books? Apparently they are largely drawn from that class of engineers, young and old, who for one cause or another are almost totally ignorant of calculus, and who find themselves greatly hampered in their professional reading by encountering the mystical $\frac{dx}{dy}$ and $\int_a^b$ signs which, with increasing frequency, are creeping into current scientific literature. In other words, they are those aspiring spirits who wish to keep up with the times.

To such the titles of these books possess an irresistible attraction, which is only increased by a perusal of the preface, wherein is set forth what the author proposes to do, namely give a clear and concise explanation of the science, for the benefit of those who wish to make use of it for practical purposes, rather than mere theoretical research. Perhaps a regret may be added, and surprise expressed, that engineers should have so long neglected to familiarize themselves with the simple and readily understood (when properly explained) processes of the calculus, by which so many intricate calculations can be performed with the greatest ease, by short cuts which ordinary mathematics do not afford. "But this is exactly the book I have been looking and longing for," exclaims the searcher after knowledge, and the book is purchased forthwith, carried home and diven into directly after dinner, that evening.

Doubtless many of the readers of the Supplement will recognize this picture, which is drawn from life. But is the promise of the title page and preface always fulfilled? Not always, certainly; very seldom, I greatly fear. On inspection, the same old and familiar difficulties are met with at the start, the same confusion exists, made only greater by the efforts at explanation, and worst of all, the same question arises,—"What is it all about, and what good is it, anyway?" On examining the problems to be solved, perhaps the eye of the student, in search of short cuts to practical problems, lights upon this:

> It is required to determine the surface bounded by two radii vectors of a parabola (the pole being at the focus) and an arc of the curve.

Not only does he personally not require this, but he does not even know what it means. Or, he may find it demonstrated, by the use of second differentials, that the space fallen through by a heavy body in a given time under the influence of gravity is $= \frac{1}{2} gt^2$. But he knew this already, from his first steps in physics, which he mastered while a boy, at the public school. In short, nearly all the practical examples either treat of things which he does not want to know, or which he knows, by simpler demonstration, already.

Most of these books possess two radical defects: In the first place, they seek a royal road through a territory which has none, and strive by strategy to turn the flank of a position which can only be successfully carried by frontal attack. Secondly, they fail in a lamentable degree to establish the practical character of the processes of calculus, and inevitably drift into pure mathematics. This is not surprising. Newton invented the calculus in order to solve problems beyond the reach of the most refined algebraic methods which his powerful mind could bring to bear upon them. Certainly this takes the science outside of the sphere of ordinary practical applications, and it may safely be asserted that any mathematical instructor will agree with the statement that it is exceedingly difficult to find examples of engineering problems which cannot be solved more readily by algebraic methods than those of calculus, always excepting questions of maxima and minima.

As regards the volume now under review, any beginner who expects to find in it a facile introduction into the elements of the differential calculus, will add another to the many similar disappointments which he has doubtless already experienced. In fact, any one beginning his study of the subject with this book, would find his efforts to master it well nigh hopeless. The title is a misnomer, and one that does injustice not only to those to whom it appeals, but also to the book itself, which is one of far more than ordinary merit. In one sense, it is true, it is a book for beginners, but for that class of beginners who, having become proficient in the subject, as developed in the standard text books, are desirous of beginning to make practical and above all intelligent applications of their already acquired knowledge to a class of advanced problems far beyond the ordinary range of scientific engineering. To such, the book may be commended in terms of the highest praise. If writing in French, the volume might well be designated as an admirable elementary treatise of "calcul raisonné." In plain English, it takes up the differential calculus where the text books leave it, and puts life and meaning into a mass of otherwise dry bones. It belongs at the other end from that indicated by its title.

Among other merits, this book serves the purpose, indirectly perhaps, of making prominent the fact that the calculus is rather the hand-maiden of the other sciences, than a self-contained science itself. For instance, to make use of it in hydrostatic calculations, we must first thoroughly understand the principles of hydrostatics. The most proficient master of calculus would be unable to find the centre of pressure on a submerged triangular surface unless he understood the hydrostatic principles involved. Knowing these, he would execute the necessary calculations with the greatest ease. In all cases we must know first what the conditions of the problem are, and what laws govern them. These laws belong to the science under which the problem falls and the calculus throws no light whatever on them. It only furnishes a mathematical instrument to which one can have recourse, to avoid tedious algebraic approximations when the element of continuous variation according to a known law is involved. In this respect it may be likened to the slide rule, which facilitates the execution of a calculation after the data have been brought into the form of an equation, as the result of independent research. Unfortunately many persons imagine that both the slide rule and the calculus possess some magic properties by which all the problems of any science whatever can be readily solved off hand, without any previous knowledge of the science itself.

When a true "Calculus for Beginners" comes finally to be written, its chief merit will consist more in what has been omitted, than in what has been retained. This is particularly true from the engineering point of view. Such a book, for engineer readers, should confine its scope to the elucidation of the narrow range of calculus problems met with in engineering literature.

*Yonkers, N. Y.

Railroad Construction for Students.

RAILROAD CONSTRUCTION.—Theory and Practice. A Text-Book for the Use of Students in Colleges and Technical Schools. By Walter Loring Webb, C. E., Assoc. M. Am. Soc. C. E., sometime Assistant Professor of Civil Engineering in the University of Pennsylvania. Second Edition, Revised and Enlarged. New York: John Wiley & Sons. London: Chapman & Hall. Leather; 4½ × 6¾ ins.; pp. 675; tables, folding plates, and 217 figures in the text. $5.

The first edition of this book, which appeared in 1900, was reviewed in our issue of July 5 of that year. The second edition has been greatly enlarged as to contents, although greatly reduced in bulk. It contains almost twice as much text as the first edition, but by using thin paper and smaller margins the work has been compressed into pocket-book size, which ought to insure a much wider use than the original form.

The author has written primarily for engineering students taking a course in railway location and railway construction. He has evidently tried to condense into one volume the essential parts of such works as those of Wellington, Tratman, Searles, Patton and Foster, and he has succeeded remarkably well—if not too well. It is true of course that an engineer actually engaged in the field work of laying out railway curves would find the tables in this book too abbreviated for rapid work, but for the student they are all that is required.

It is also true that very little of the matter relating to signals and to signaling would enable an engineer to design any part of such a plant, but the student may gain a bird's-eye view of signaling practice. It is true that what the author gives on tunneling is so meager as to be of little practical value, except to the student who may thus be prepared for a study of some of the manuals on the subject. In a word, the objection to the book as a whole, in the eyes of the practicing engineer, is that every part is too much condensed. It is too much like the celebrated "marching ration pellets of super-condensed nutriment" that a certain inventor sought to introduce during the Civil War.

Perhaps the best way of conveying a clear idea of the contents of the book is to give the pages devoted to each subject which are as follows: Reconnoissance and Preliminary Surveys, 19; Simple, Compound and Transition Curves, 42; Earthwork Computation and Design, 60; Earthwork Cost, 15; Blasting, 10; Trestles, 30; Tunnels, 18; Culverts and Minor Openings, 18; Ballast, 5; Ties, 15; Rails, 14; Rail-Fastenings, 16; Switches and Crossings, 34; Buildings, Yards and Signals, 36; Rolling Stock, 51; Cost of Railroads, 8.

The foregoing forms the first part of the book. The second part is entitled Railroad Economics, to which 100 pages are devoted. It is in this part that the principles formulated by Wellington, together with his most useful tables, are given. The author is to be especially commended for having so well condensed the matter hitherto to be found only in Wellington's "Economic Theory of Railway Location," which, although in the stock phrase of reviewers, "is a mine of information," yet is almost too comprehensive for class use as a text book. But again it may be urged by many that the condensation has been carried too far. The remaining 140 pages of the book contain the tables and the index. Of the latter it may be said that it is a decided improvement over the index in the first edition.

While the book as a whole is exceedingly well compiled for the purpose for which it was designed, it is of course possible to find many minor flaws, such, for example, as occur most frequently in matter pertaining to costs. The same old and often misleading cost data of Trautwine and Morris are to be found in the earthwork chapter. And we read that a contractor's profits on earthwork should be estimated at 6 to 15%, although he is a a rare man who can estimate the actual cost of a new earthwork job within 15% to begin with. We see also the same old "model railway embankment," with its concave layers, which exists only in text books. We are told that a contractor should make all fills 8 to 15% higher than the profile calls for to allow for shrinkage—when as a matter of fact nearly all shrinkage occurs during construction, not afterward.

However, the author is not wholly to blame for copying alleged facts announced by others, and so often repeated that they seem to have the weight of many authorities back of them. But had the author traced the origin of some of these empirical rules he might have accepted them with less faith if he accepted them at all.

It is this tendency of the author to accept on faith much that he has seen in print that leads him to reproduce designs of "pile-shoes" such as we find on p. 156. The crossed wrought-iron strap type of shoe has long been known to be utterly worthless as a protection to the toe of a pile. The cast-iron shoe, with a long drift-bolt cast in its base, is one almost impossible to fasten to a pile; it is furthermore unnecessarily heavy if made as shown, for by making a simple hollow cast-iron cone, a shoe is produced that is half as heavy and readily applied.

What the author has to say on the cost of timber trestles is indicative of much that pertains to costs in the book. We quote:

> The work per M., B. M., is small, considering that a stick 12 ins. × 12 ins. × 25 ft. contains 300 ft., B. M., and that sometimes a few hours' work, worth less than $1, will finish all the work required on it. Smaller pieces will of course require more work per foot, B. M. Longleaf pine can be purchased at the mills at from $8 to $12 per M. feet, B. M., according to dimensions. To this must be added the freight and labor of erection. The cartage from the nearest railroad to the trestle may often be a considerable item. The amount of iron used depends on the detailed design, but, as an average, will amount to $1.50 to $2 per 1,000 ft., B. M., of timber. A large part of the trestling of the country has been built at a contract price of about $30 per 1,000 ft., B. M., erected. While the cost will frequently rise to $40 and even $50 when timber is scarce, it will drop to $13 (cost quoted) when timber is cheap.

Comment is almost superfluous. This is the kind of information that doesn't inform. It leaves the student about as able to estimate the cost of a trestle as the cost of a balloon.

An Elementary English Text Book on Gas Manufacture.

GAS MANUFACTURE FOR STUDENTS.—By John Hornby. London: Geo. Bell & Sons. New York: The Macmillan Co. Cloth; 5 × 7 ins.; pp. 265; 6 plates and 65 figures. $1.50.

It is strange that a department of engineering so important as the construction and operation of gasworks should be so deficient in up-to-date comprehensive treatises on the subject. There is no American book on gas engineering, and, unless it be the recently announced new work by Dibdin, all the English treatises are old, or are founded on the old ones. The volume before us, the author states, was written to meet the needs of young men just entering gas works, or preparing for the gas examinations of the City and Guilds of London Institute. The book was written in 1896, revised in 1900, and reprinted in 1902. The author makes no claims to originality, drawing freely upon the writings of others. The treatment is wholly English, and would be of little service in this country, except for comparative purposes, were good American books available. It should be added, that the lack of American books is partly met by the work of the educational committee of the American Gas Light Association, which, under the direction of Mr. Alfred E. Forstall, Secretary, carries on a correspondence course of instruction. Mr. Hornby's book describes the design and construction of gas works, from the retorts to the consumers' meters and burners; discusses the properties of various gas coals, the effects of temperature on the quantity and quality of gas, and of temperature and pressure on the volume of gas; has a chapter on photometry and appendixes on the sulphur and the oxide of iron test; and takes up a multiplicity of other features of gas manufacture. It is clearly written and has serviceable illustrations, but the value of the latter would have been greatly increased by the use of more descriptive lettering. The frontispiece, for instance, shows the various parts of a gas works, from the retort to the gasholder, but not a single element of the plant is named on the plate, and there are no reference figures to descriptive matter given elsewhere.

SURVEY OF TIDES AND CURRENTS OF CANADIAN WATERS.—By W. Bell Dawson, D. Sc., C. E., In Charge of Tidal Survey. Ottawa, Ont.: Pub. Doc. Paper; pp. 27; tables.

Tide level and current observations on the St. Lawrence River, the Cabot and Northumberland straits, and the Pacific Coast are given herein.

NOTES ON METALLURGICAL ANALYSIS.—Arranged for Students in Metallurgical Chemistry. Selected Methods for the Analysis of Iron and Steel and of the Materials used in their Manufacture, including the Analysis of Gases, Fuels, Water for Boiler Supply, etc. Together with Explanatory Notes on the Manipulation and Chemistry of the Various Processes. By Nathaniel Wright Lord, E. M., Professor of Metallurgy and Mineralogy at the Ohio State University and Consulting Chemist of the Ohio Geological Survey. Second Edition, Rewritten and Greatly Enlarged. Columbus, O.: Metallurgical Laboratory, Ohio State University. Cloth; 6 × 9 ins.; pp. 228; illustrated. $2.50.

These "Notes" were written for the use of the author's students, and they so closely follow the original form that the subjects are not separated into numbered chapters. Modern methods are given for the analyses of limestone, iron ores, iron and steel, coke and coal, furnace and flue gas, furnace slags, fire clays, copper and zinc ores, alloys of lead, antimony, tin and copper, and water for boilers. One of the commendable features of this book is the list of references to articles in the technical journals and transactions, which is to be found at the end of each lecture. It would be well if all authors of technical text-books were as careful to provide such references; for the student then has a means of determining the source of the author's own information, and of studying the details of any particular subject not treated exhaustively in the text-book. A large part of one's technical knowledge is the knowing where to find desired data. Professor Lord has shown his appreciation of the importance of such knowledge by his frequent reference to other authorities. It is to be hoped that future editions of these "Notes" will be indexed.

FOREIGN TRADE REQUIREMENTS.—Containing Complete Information Concerning the Commercial Countries of the World as to Trade Conditions, Traveling Salesmen, Agencies and Advertising, Credit, Customs, Commercial, Trade Mark and Patent Laws, Transportation Facilities, Principal Cities, Postal Regulations, Coins, and Currencies, Weights and Measures, and Cable Rates. New York: Lewis, Scribner & Co. Cloth; 9 × 1₄ ins., pp. 532. $10.

The subject matter of this book is arranged so as to make reference easy; for each country is placed in its alphabetical order. The trade conditions in each country are given in considerable detail, together with practical hints for the merchant contemplating sending circulars or salesmen abroad. The larger towns and cities are enumerated, names of hotels and banks are given, and, in a word, an effort is made to answer every question that a merchant or traveling salesman might ask. A part of the book is devoted to patent and trade-mark laws of the countries of the world. The transportation facilities of each country are well summarized. Coinage and weights and measures are given in detail. Finally, at the end of the book there is an alphabetical list including every city in the world having a population of more than 10,000, and in a few lines its population, railway service, industries, etc., are enumerated. This book should be exceedingly useful to all merchants and manufacturers who are shipping or intend to ship produce abroad.

CATALOGUE OF THE LIBRARY OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.—Vol. II., December, 1902. Prepared by the Secretary, under the direction of the Library Committee. New York: The Society. Paper; 6 × 9 ins.; pp. 293.

The first volume of this catalogue was published in 1900 and was fully reviewed in Engineering News of Dec. 13, 1900, and the second volume, which is now before us, is simply a continuation of the first, and is of the same scope and character as regards its contents. It contains references to all new books received between June, 1900, and December, 1902, and also to periodicals to the files of which there have been accessions. Like Vol. I., it contains the classified index only, the author and subject indexes being available for consultation in the reading room of the library.

AMERICAN SOCIETY FOR TESTING MATERIALS.—Proceedings of the Fifth Annual Meeting at Atlantic City, N. J., June, 1902. Philadelphia: Office of the Secretary, University of Pennsylvania. Paper; 6 × 9 ins.; pp. 388; illustrated.

In these proceedings there are a number of excellent papers, such as that on "Steel Rivets," by Professor Lanza, that on "Tests of Reinforced Concrete Beams," by W. K. Hatt, and others. There are also many valuable topical discussions, such as those on steel, steel rails, cement and cast iron.

APPORTIONMENT OF CHARGES FOR PRIVATE FIRE PROTECTION AND THE MEANS OF CONTROLLING THE SUPPLY THERETO. Reports of Committee and Discussion, Sept. 11, 1902.—By F. H. Crandall, C. E., Burlington, Vt., Chairman; Byron I. Cook, Inspector Associated Factory Mutual Insurance Cos., Boston, Mass., and five others. Reprinted from the "Journal of the New England Water-Works Association." Vol. XVI., No. 4. Paper; 6 × 9 ins.; pp. 40; illustrated. Address the members of the committee, or obtain the "Journal," as named ($1) from the Secretary, Tremont Temple, Boston, Mass.

This committee failed to agree, so we have here three reports: One from the three water-works superintendents, one from the three representatives of the insurance interests, and one from Mr. John C. Chase, M. Am. Soc. C. E., of Derry, N. H. The water-works superintendents believed that water is surreptitiously taken through fire services; that there should be a charge for private fire protection service; and, we assume, that such supplies should be metered. The insurance men acknowledged that water is taken in some cities without the knowledge of the water departments, but that in the majority of cases there was no "intentional stealing," the takings being due to "a lax view of the rights in the case"; they believed that it was unjust to charge for private fire service, that meters were prejudicial to fire protection, and that other means of preventing misappropriation of water were available; they also suggested a number of other points of interest. Mr. Chase took somewhat of a middle position. The bulk of the report is taken up with a general discussion of the committee reports. The subject is one of great interest and importance, and a new committee, consisting of three water-works men, including Mr. Crandall, has been appointed to confer with like committees from other associations interested in the matter from the water-works and insurance viewpoints.

THE MOTIONS OF UNDERGROUND WATERS.—By Prof. Charles S. Slichter. No. 67, Water Supply and Irrigation Papers. Washington, D.C.: U.S. Geological Survey. Paper; 6 × 9 ins.; pp. 106; tables, 8 plates, and 50 figures in the text.

All in all, this is one of the most useful papers in the series, and it would hardly seem as though any engineer who has to do with the development of water supplies from underground sources, or the movement of water through the soil, could afford to be without a copy. It may be remembered by some that Part II. of the Report of the U. S. Geological Survey for 1897-8 consisted of two long papers on the movements of ground water; Prof. F. H. King discussing the principles and conditions, and Professor Slichter presenting a theoretical study of the subject. In the present paper the author treats the "simpler and more general topics connected with the movements of water underground," and answers "the more elementary questions which arise in a consideration of the subject." Nevertheless, this is no mere popular essay, but a practical and a scientific exposition of the motions of water through the earth, with particular reference to their actual or potential availability as water supplies. After discussing the origin and extent of underground waters, and means of determining their flow, the author takes up waters that flow at, and at varying distances below, the surface, and their recovery by means of shallow wells, springs, collecting galleries, subsurface dams, and artesian wells. The paper is well illustrated. The author's electrolytic method of determining the rate of the underflow was illustrated and described in Engineering News for Feb. 20, 1902.

HYDROGRAPHY. Part IV.—Twenty-second Annual Report U. S. Geological Survey. Washington, D. C.: Pub. Doc. Cloth; 8 × 11½ ins.; pp. 690; illustrated.

In our issue of March 19 we reviewed Parts I. to III., inclusive, of the latest report of the Geological Survey. This, the last volume of the Directors' Annual Report, is given over entirely to records of rainfall, runoff and river gagings. It contains a vast amount of data that will be of increasing value in the solution of problems of water supply, power development, and irrigation. "The Hydrography of the American Isthmus" is treated (115 pages) by Arthur Powell Davis, and a comparison of isthmian canal routes is made. An exceedingly interesting paper (pp. 30) is that by Willard D. Johnson, entitled "The High Plains and Their Utilization." The semi-arid high plains of the middle west are shown to be especially adapted to stock raising when wells shall have been sunk to supply water for stock, and it is also shown that these plains can never be used for agricultural purposes other than stock raising. This volume is praiseworthy in every way, and any engineer having to do with problems of water supply in any form will find it full of valuable information.

LIME AND CEMENT INDUSTRIES OF NEW YORK.—By Heinrich Ries, Ph.D. With Chapters on the Cement Industry in New York. By Edwin C. Eckel, C. E. Bulletin 44, Vol. 8 (November, 1901). New York State Museum. Albany, N. Y.: University of the State of New York. Cloth; 7 × 10 ins.; pp. 328; tables, plates, and two pocket maps.

No natural rock has a greater number of industrial uses than limestone. In the manufacture of lime and cement, and in the smelting of iron, it is almost indispensable; it is also consumed in large quantities in the manufacture of paper, glass, sugar, soda and a number of other substances. In view of these facts this report, whose purpose it is to give information to quarry owners concerning the uses of limestone and the characters which the stone should possess to make it of value for these different applications and to supply limestone consumers with information regarding the extent and character of the limestone formations of New York state, has a most commendable object. In further introduction to the contents of the report it should be mentioned that the main report is written by Prof. Heinrich Ries, of Cornell University, and is supplemented by a number of appendices written and compiled by Mr. Edwin C. Eckel and by Professor Ries.

Professor Ries' report opens with a number of sections on general topics, such as the origin, chemical composition, geologic occurrence, color and mineralogic composition of limestone, and with a section giving some general instructions as to methods of prospecting limestone. The various uses of limestone, both in its raw state and in manufactured forms, are then described. There are short sections on paper-making, glass manufacture, furnace flux, sugar manufacture, chloride of lime, carbon dioxide, soda manufacture and lithographing. The information given in these sections is of a very general character, but is probably adequate for the purpose intended. A discussion of the manufacture and uses of lime follows, and is on the whole a satisfactory general outline of the subjects treated. There follows about 40 pages on natural and Portland cement manufacture, and about 30 pages on cement testing and cement specifications. For the specific purpose of the report, as stated above, a considerable portion of this discussion is unnecessary, and as a technical guide to the cement manufacturer and engineer it is very nearly valueless, it being a perfunctory rehash of matter already published elsewhere and selected without much care to exclude obsolete practice and information. Had the writer contented himself with describing the chemical and physical characteristics which fit limestone for use in cement making, and left the subjects of manufacture, testing and engineering regulation alone he would have met the specific object of the report quite as adequately and have saved much space.

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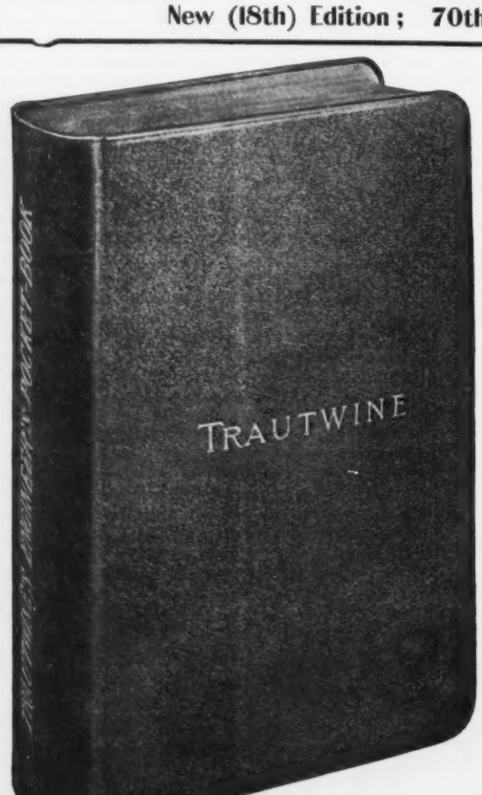

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short and satisfactory description of the geology of New York limestones, and this is followed, in turn, by about 60 pages of description of limestone occurrence by counties, which constitutes one of the most valuable parts of the report. In these descriptions the attempt is made to give as far as possible the occurrence and extent of the different limestone formations in each county, together with their characters and such chemical analyses as are available and the titles and nature of such reports as have been made upon them. A list of the firms producing lime and cement in New York state follows, with brief descriptions of the more important manufacturing centers and of the cement and lime factories there in operation. The appendices consist of two papers, one on the "Early History of the Portland Cement Industry in New York State," and the other on "Manufacture of Portland Cement in New York State," and both written by Mr. Edwin C. Eckel; of a tabulation of the results of the cement tests made by the State Engineer's office during 1897-1900, and of a long table of "Analyses of Limestones of the United States," with a key to the table. The bulk of Mr. Eckel's two papers on cement manufacture in New York state was published in Engineering News of May 16, 1901.

CONNECTICUT SEWERAGE COMMISSION.—Report for 1902. R. A. Cairns, M. Am. Soc. C. E., Waterbury, Conn., and Others, Commissioners. Paper; 6 x 9 ins.; pp. 45; tables, folding map in pocket, and figures in the text.

After a brief review of the several sewage purification works in Connecticut this report devotes a section to "The Water Supplies of Connecticut and Their Connection with Sewage Disposal." This section includes a tabular list of the drainage areas of the potable water supplies of the various municipalities of Connecticut, the area in each case being given in square miles. Other tables show the municipalities supplied with water and having and not having sewerage systems, with the areas of each city, town and village. The tables are supplemented by a large folding map. About half of the report is given up to a paper on the "Action of the Septic Tank on Acid Iron Sewage," by Prof. Leonard P. Kinnicutt and Harrison P. Eddy, of Worcester, Mass. An abstract of this paper was published in Engineering News of April 2, 1903, and it has been printed separately for the authors.

SOME PRACTICAL SUGGESTIONS ON MOSQUITO EXTERMINATION IN NEW JERSEY.—By Henry Clay Weeks, Bayside, L. I. Read Before the New Jersey Sanitary Association, October, 1902, and reprinted from the "Medical News," March 7, 1903. Paper; 5 x 8 ins.; pp. 17. Address the Author.

This interesting and practical discussion of mosquito extermination is as suggestive for other regions infested with mosquitoes and malaria as for New Jersey. The abolition of breeding places by filling or draining pools and swamps is a proposition that will appeal forcibly to engineers as a permanent solution of the mosquito problem. Where this cannot be done resort may be had to spraying with oil. Organization against the common foe, with recourse to state legislation, may be necessary; and even the exercise of the right eminent domain may be required in some localities before the necessary work can be accomplished.

OHIO STATE BOARD OF HEALTH.—Report for 1901. C. O. Probst, Secretary. Columbus, O.: The Board. Cloth; 7 x 10 ins.; pp. 495; tables, folding map and diagrams.

Among other things, this volume contains numerous reports on proposed water-works and sewage disposal schemes, submitted to the board for approval, and on the quality of existing water supplies. The work of the laboratory in 1901 is given in detail, including many analyses, by Mr. Elmer G. Horton, Chemist and Basteriologist, and Mr. Homer D. Williamson, Assistant. There is a special report on the "Sanitary Condition of School Buildings in Cities and Villages in Ohio," accompanied by a long statistical table. Three appendixes conclude the volume: (1) "Fifth Report of an Investigation of the Rivers of Ohio as Sources of Public Water Supply," in which Mr. Horton takes up the Ohio River and Lake Erie, and the water supplies therefrom, and the late Mr. B. H. Flynn, until recently Engineer of the Board, reviews the sources of pollution affecting those supplies; (2) "Second Report Upon the Condition of the Public Water Supplies of Ohio," covering 54 cities, by Mr. Flynn; (3) "Steam Gagings," which are very few in this report, owing to the death of Prof. C. N. Brown. It may be inferred, even from so bare an outline of the contents of this volume, that it is far more interesting to engineers than most reports of state boards of health.

THE NATIONALIZATION OF MUNICIPAL MOVEMENTS.—By Clinton Rogers Woodruff. North American Building, Philadelphia. Reprinted from the Annals of the American Academy of Political and Social Science. Philadelphia: American Academy. Paper; 6 x 10 ins.; pp. 9.

The author reviews briefly the interest in various phases of municipal affairs shown by the national engineering and municipal organizations, but devotes himself chiefly to the National Municipal League, the American Society of Municipal Improvements, the League of American Municipalities, the American Park and Outdoor Art Association, and the American League for Civic Improvements. He doubts whether the time for a federation of these societies has yet arrived, but thinks

a permanent secretary to serve all five bodies and to be made a center of municipal endeavor in the United States, is a feasible step which can and should be undertaken without delay.

TENTH ANNUAL REPORT OF THE MASSACHUSETTS HIGHWAY COMMISSION. Boston, Mass. 6 x 9 ins.; pp. 82; with road map.

The report contains the usual tables, showing the nature and extent of the roads built or contracted for by the commission, detailed contract prices and names of contractors in 1902, costs per mile of road built in 1902, total and mileage expenditures for repairs, by towns, prior to and in 1902, and the kind and length of road, by town, built under the "Small Town" act. The text of the report is briefer than usual.

ROAD IMPROVEMENT ASSOCIATIONS.—Washington, D. C.: U. S. Department of Agriculture, Office of Public Road Enquiries. Paper; 6 x 9 ins.; pp. 14.

This is a list of the various national, state and local road associations in the United States, with lists of officers.

NORTH CAROLINA GOOD ROADS CONVENTION.—Compiled by A. L. Holmes. Washington, D. C.: U. S. Department of Agriculture, Office of Public Road Enquiries. Paper; 6 x 9 ins.; pp. 72; illustrated.

This convention was held at Raleigh, N. C., in February, 1902.

BAROMETRY OF THE UNITED STATES, CANADA AND THE WEST INDIES.—Prepared Under the Direction of Willis L. Moore, Chief of Weather Bureau, by Frank H. Bigelow, Professor of Meteorology. Vol. II., Report of the Chief of the Weather Bureau, 1900-1. Washington, D. C.: Pub. Doc. Cloth; 9 x 12 ins.; pp. 1005; 55 tables and 39 charts.

The scope of this report is well indicated by a prefatory note in which it is stated that the volume

contains a revision of the meteorological data which have become available since the opening of the Government service in 1871, in order to prepare it on modern scientific principles for the forecasting work of the bureau. It contains the material necessary for constructing daily weather maps on three planes, the sea level, the 3,500-ft. plane and the 10,000-ft. plane; also normal values of the pressures, temperatures and vapor pressures at the stations and on these three planes. This work will be a standard of reference not only for the Weather Bureau, but for all branches of science requiring such data. The United States has thus taken the lead in reducing its barometric observations to a standard system, and it is hoped that other countries will soon be able to do a similar work for their own observations.

Before taking up the detailed local records of barometric pressures and their reduction to sea level there is presented a lengthy review of reduction methods from 1870 to 1901.

SCHOOL GARDEN PAPERS.—Presented at the Sixth Annual Meeting of the American Park and Outdoor Art Association, Boston, Aug. 5 to 7, 1902. Rochester, N. Y.: Chas. M. Robinson, Secretary. Paper; 6 x 9 ins.; pp. 41. 25 cts. (to members).

A school garden is defined in one of these papers as a "nature-study laboratory." They are extensively used in some foreign countries, and are becoming frequent in America. Appended to this series of papers is a bibliography of four pages.

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The Current Literary Magazines.

"The Evolution of American Census Taking," by Hon. W. R. Merriam, Director of the Census of 1900, in the April "Century" is an interesting account of the changes which have taken place in the decennial enumeration since the first census was taken in 1790. As many of our readers know, the prompt tabulation of the statistics of the last two censuses has only been made possible by the use of mechanical tabulating machines in place of hand work, and the apparatus used is described in the article.

There is much food for thought in a graphic description of Butte City, Montana, which we also find in this month's "Century." Here is a city whose mines are yielding a yearly product valued at $55,000,000. Its workmen receive high wages and short hours are the rule; but their surplus money and leisure is spent on gambling, drinking and vice as a rule and not on anything that adds to their real welfare. High wages and short hours are no benefit to the workingman unless he will use them for some better purpose than his own self destruction. A third "Century" article which should be mentioned here is a paper on the "Steamship Trust."

Two important transcontinental railway projects are described in the current "Review of Reviews." One of these is the proposed Trans-Canada railway, which is to run from northern Quebec across the continent to a terminus on the Pacific at Port Simpson. The other is the line across Australia for which bids have been asked by the Government of South Australia. The paper describing it is written by the Attorney-General of South Australia and will be of particular interest, therefore, to any of our readers who desire particulars concerning the project. The same magazine contains an interesting review of the municipal campaign in Chicago which has just closed.

The recent rapid growth of the Canadian Northwest is described by Mr. Wm. R. Stewart in the "Cosmopolitan." He estimates the possible grain production of the Canadian Northwest, when the country is fully settled at 2,000,000,000 bushels per annum. In 1902 the production was nearly 116,000,000 bushels and the railways were unable to move it to market.

Lemon growing in California is the subject of a paper in the April "World's Work." The extreme southern part of California is the place where a climate suitable for lemon growing is found and 600,000 boxes of lemons were shipped east from here last year. The land where the lemons are grown was a desert until reclaimed by irrigation. "The Railroads and Forestry" in the same magazine describes the work which is being done by some leading railway companies in the cultivation of the timber, etc. The Kansas City, Fort Scott & Memphis R. R. planted 400 acres of land between 1877 and 1884 with hardy catalpa. This plantation has cost to date $124.51 per acre and the trees now on it are estimated to be worth $390.21 per acre. Allowing 6% compound interest on the investment, there is left a clear profit of $138.19 per acre. The Bureau of Forestry has recently been requested to prepare plans for the reforestation of 150,000 acres of lands belonging to the Baltimore & Ohio R. R. in West Virginia.

In the "North American Review" for April an author who signs himself "An American Business Man," writes on "The Monroe Doctrine a Bar to Civilization." He sets forth the condition of almost continuous anarchy which has prevailed in most of the so-called republics of South America ever since Spain relinquished her hold upon them, and he urges that something should be done to check this devastation and establish real civilization in these regions. We quote the following paragraphs:

> That the United States, magnificent exponent of modern civilization, should throw itself as the mightiest barrier which the world has ever known across the stream of human progress; that it should condemn the great continent of South America to everlasting barbarism, is a pity!
>
> How long, in good conscience, can the United States permit herself to remain the confrère of thieves and brigands, in the attempt to protect these violent, dangerous, and wholly irresponsible dictatorships from the punishment they so richly deserve at the hands of an outraged world. If the United States would assume the responsibility of intervention for the maintenance of law and order in those countries—in other words, if it would police all of Latin America, and prevent the perpetration of outrages, not only against foreigners, but also against their own helpless population, then it could with some show of dignity and good faith say to Europe, "Hands off."
>
> To talk of our becoming involved in war with Germany, as many newspapers have done, because of the Venezuelan affair is utterly indefensible. Such a war would be the mightiest crime of all history, in which the United States would be in eternal and unextenuated wrong. No higher, nobler, grander service could be done to humanity, to the Latin Americans themselves, and to civilization for all time, than for Germany, England and the United States to take joint possession and control of all Latin-American countries, except the three previously mentioned, and govern them in the same manner as these nations govern their dependencies. Until this is done, there will be no peace in the Western Hemisphere.

In "The Forum" for the current quarter we find a capital paper on submarine boats by Commander F. M. Barber, U. S. N., retired. He states that the situation of the submarine boat is similar to that of wireless telegraphy. "It is new and has its defects, but all navies must have it as it is, though every day sees new improvements."

In "Scribner's" this month we find a paper giving reminiscences from the experience of an assistant engineer on an ocean steamer. He tells a story of a vessel starting on a voyage and passing down a crowded harbor when a gland on an ammonia compressor sprung a leak and sent the whole engine-room force under the ventilator to escape suffocation. The account continues:

> No one knew what might happen if the signals from the captain's bridge were left unheeded, yet they kept coming and the engineers with streaming eyes kept groping for their levers to answer them; but they couldn't do it many minutes more.

The dangerous situation was finally met by a greaser with a diver's helmet who was able to reach the leaking gland and repair it.

One wonders whether this story is fact or fiction. We did not suppose such a thing as an ammonia compressor in a marine engine room existed. Certainly any such installation is a stupid crime against humanity. The dense air refrigerating machines and the carbon dioxide machines have taken away any excuse for using an ammonia compressor on ship board.

In the "Fortnightly Review" for March, Col. Geo. Earl Church describes the projected new transcontinental railway in Canada, the Trans-Canada Ry., which is to extend from the Saguenay across the Continent to Port Simpson, a total distance of 2,830 miles. The paper is accompanied by a large map of the proposed road.

SUPPLEMENT TO THE COAL NUMBER OF THE INDIAN MERCURY.—By C. Kraalj, 322 Kerkstraat, Amsterdam, Holland. Paper; 12 × 16 ins.; pp. 6.

This supplement, dated Jan. 1, 1903, contains some later information regarding the coal industry and interests of the world than was given in the original "Coal Number," noticed briefly in our issue of Dec. 19, 1902.

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GAS AND ELECTRIC LIGHT COMMISSIONERS OF MASSACHUSETTS.—Report for 1902, including Tables from the Annual Returns for the Year Ending June 30, 1902. Boston: The Commissioners. Paper; 6 × 9 ins.; pp. 222 + excill.; many tables.

This report still continues, as it has for nearly twenty years, to be the only public source of detailed information regarding gas and electric lighting plants in any of the American states. Some "Directories" of the lighting interests of the whole country are published at private expense, and are good as far as they go, but their range of information is limited. The present report of the commission contains the usual review of hearings and decisions on the reduction of rates and other petitions; of asphyxiation; of steps to establish municipal lighting plants; and it also contains the usaul statistics showing the character and extent of the several plants, the rates for public and private lighting, and the financial and other operations of the plants for the year.

PUBLICATIONS RECEIVED.

CALORIMETRY.—By Frank H. Bates. Vol. II. of the Industrial Gas Series. Philadelphia: Philadelphia Book Co. Leather; 4½ × 6¾ ins.; pp. 129; tables, and 28 figures in the text. $1.

CONGRES INTERNATIONAL D'AUTOMOBILE.—Universal Exposition of 1900. Paris. Hemmerlé et Cie. Paper; 8 × 11 ins.; pp. 605; illustrated.

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